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AERONAUTICAL ENGINEERING

A CONTINUING BIBLIOGRAPHY WITH INDEXES

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Each entry in the publication consists of a standard bibliographic citation accompanied, in most cases, by an abstract.

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Typical Report Citation and Abstract

❶ 19970001126 NASA Langley Research Center, Hampton, VA USA
❷ **Water Tunnel Flow Visualization Study Through Poststall of 12 Novel Planform Shapes**
❸ Gatlin, Gregory M., NASA Langley Research Center, USA Neuhart, Dan H., Lockheed Engineering and Sciences Co., USA;
❹ Mar. 1996; 130p; In English
❺ Contract(s)/Grant(s): RTOP 505-68-70-04
❻ Report No(s): NASA-TM-4663; NAS 1.15:4663; L-17418; No Copyright; Avail: CASI; A07, Hardcopy; A02, Microfiche
❼ To determine the flow field characteristics of 12 planform geometries, a flow visualization investigation was conducted in the Langley 16- by 24-Inch Water Tunnel. Concepts studied included flat plate representations of diamond wings, twin bodies, double wings, cutout wing configurations, and serrated forebodies. The off-surface flow patterns were identified by injecting colored dyes from the model surface into the free-stream flow. These dyes generally were injected so that the localized vortical flow patterns were visualized. Photographs were obtained for angles of attack ranging from 10’ to 50’, and all investigations were conducted at a test section speed of 0.25 ft per sec. Results from the investigation indicate that the formation of strong vortices on highly swept forebodies can improve poststall lift characteristics; however, the asymmetric bursting of these vortices could produce substantial control problems. A wing cutout was found to significantly alter the position of the forebody vortex on the wing by shifting the vortex inboard. Serrated forebodies were found to effectively generate multiple vortices over the configuration. Vortices from 65’ swept forebody serrations tended to roll together, while vortices from 40’ swept serrations were more effective in generating additional lift caused by their more independent nature.
❽ Author
❾ *Water Tunnel Tests; Flow Visualization; Flow Distribution; Free Flow; Planforms; Wing Profiles; Aerodynamic Configurations*

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AERONAUTICAL ENGINEERING

A Continuing Bibliography (Suppl. 383)

SEPTEMBER 18, 1998

01 AERONAUTICS

19980206747 NASA Lewis Research Center, Cleveland, OH USA
A Moving Grid Capability for NPARC
Slater, John W., NASA Lewis Research Center, USA; Jun. 1998; 14p; In English; 36th; Aerospace Sciences Meeting and Exhibit, 12-15 jAN. 1998, Reno, NV, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA
Contract(s)/Grant(s): RTOP 509-10-51
Report No.(s): NASA/TM-1998-207944; NAS 1.15:207944; E-11223; AIAA Paper 98-0955; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Version 3.1 of the NPARC computational fluid dynamics flow solver introduces a capability to solve unsteady flow on moving multi-block, structured grids with nominally second-order time accuracy. The grid motion is due to segments of the boundary grid that translate and rotate in a rigid-body manner or deform. The grid is regenerated at each time step to accommodate the boundary grid motion. The flow equations and computational models sense the moving grid through the grid velocities, which are computed from a time-difference of the grids at two consecutive time levels. For three-dimensional flow domains, it is assumed that the grid retains a planar character with respect to one coordinate. The application and accuracy of NPARC v3.1 is demonstrated for flow about a flying wedge, rotating flap, a collapsing bump in a duct, and the upstart / restart flow in a variable-geometry inlet. The results compare well with analytic and experimental results.
Author
Computational Fluid Dynamics; Flow Equations; Mathematical Models; Structured Grids (Mathematics); Rigid Structures

19980210004 Logistics Management Inst., McLean, VA USA
Aviation System Analysis Capability Executive Assistant Design *Final Report*
Roberts, Eileen, Logistics Management Inst., USA; Villani, James A., Logistics Management Inst., USA; Osman, Mohammed, Logistics Management Inst., USA; Godso, David, Logistics Management Inst., USA; King, Brent, Logistics Management Inst., USA; Ricciardi, Michael, Logistics Management Inst., USA; May 1998; 218p; In English
Contract(s)/Grant(s): NAS2-14361; RTOP 538-08-11-01
Report No.(s): NASA/CR-1998-207679; NAS 1.26:207679; LMI-NS701S1; No Copyright; Avail: CASI; A10, Hardcopy; A03, Microfiche

In this technical document, we describe the design developed for the Aviation System Analysis Capability (ASAC) Executive Assistant (EA) Proof of Concept (POC). We describe the genesis and role of the ASAC system, discuss the objectives of the ASAC system and provide an overview of components and models within the ASAC system, and describe the design process and the results of the ASAC EA POC system design. We also describe the evaluation process and results for applicable COTS software. The document has six chapters, a bibliography, three appendices and one attachment.
Author
Systems Engineering; Design Analysis; Management Systems; Procedures

02 AERODYNAMICS

Includes aerodynamics of bodies, combinations, wings, rotors, and control surfaces; and internal flow in ducts and turbomachinery.

19980209691 Naval Postgraduate School, Monterey, CA USA
Flight Testing and Real-Time System Identification Analysis of a UH-60A Black Hawk Helicopter with an Instrumented External Sling Load
McCoy, Allen H., Naval Postgraduate School, USA; Dec. 1997; 104p; In English
Report No.(s): AD-A343449; No Copyright; Avail: CASI; A06, Hardcopy; A02, Microfiche

Historically, helicopter and load combinations have been qualified through flight testing, requiring considerable time and cost. With advancements in simulation and flight test techniques, there is potential to substantially reduce costs and increase the safety of helicopter sling load certification. Validated simulation tools make possible accurate prediction of operational flight characteristics before initial flight tests. Real time analysis of test data improves the safety and efficiency of the testing programs. to advance these concepts, the US Army and NASA, in cooperation with the Israeli Air Force and Technion, under a Memorandum of Agreement, seek to develop and validate a numerical model of the UH-60 with sling load and demonstrate a method of near real time flight test analysis. This thesis presents results from flight tests of a US Army Black Hawk helicopter with various external loads. Tests were conducted as the US first phase of this MOA task. The primary load was a container express box (CONEX), which contained a compact instrumentation package. The flights covered the airspeed range from hover to 70 knots. Primary maneuvers were pitch and roll frequency sweeps, steps, and doublets. Results of the test determined the effect of the suspended load on both the aircraft's handling qualities and it's control system's stability margins. Included were calculations of the stability characteristics of the load's pendular motion. Utilizing CIFER
DTIC
Computerized Simulation; Flight Characteristics; Flight Simulation; Frequencies; Real Time Operation; UH-60A Helicopter; Control Stability; Aerodynamic Loads

19980209729 Army Research Lab., Aberdeen Proving Ground, MD USA
Dynamic Analyses of the Mortar Dragster Tab Mechanism *Final Report*
Condon, John A., Army Research Lab., USA; Hollis, Michael S., Army Research Lab., USA; Apr. 1998; 25p; In English
Report No.(s): AD-A345815; ARL-TN-107; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

As a means of verifying the design and operation of the Mortar Dragster, a commercially available, three-dimensional rigid body dynamics simulation program was exercised. The Mortar Dragster is a conceptual design for a range correction device for the 81-mm mortar. The design includes a series of drag surfaces, or tabs, which are actuated at some point in the trajectory of the projectile. The actuation places the entire series of drag surfaces into the airstream, thus slowing the projectile. of specific interest are the collision forces and resulting tab hinge loads imparted by the opening tabs impacting the adjacent connected body because of integral torsion springs and air drag-induced torque loads. Collision forces predicted by the simulation program were of the same order of magnitude as hand calculations. The results of this investigation provided confidence in the final design of the tab mechanism before its flight testing and also provided further verification of the simulation program's performance.
DTIC
Aerodynamic Drag; Dynamic Tests; Computerized Simulation; Mortars (Material)

19980209732 Arnold Engineering Development Center, Arnold AFS, TN USA
Development of the Porous-Slot Geometry of the NWTC Test Section
Steinle, Frank W., Jr., Arnold Engineering Development Center, USA; Jan. 1997; 14p; In English; 35th; Aerospace Sciences, 6-10 Jan. 1997, Reno, NV, USA
Report No.(s): AD-A345793; AIAA Paper 97-0097; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The development of the concept features of the wall configuration of the National Wind Tunnel Complex project is described in the context of the project history. Flow quality requirements concerning stream angle homogeneity at the outer edge of the test volume, requirements for maximum wall interference, optical access, and test volume acoustic considerations in addition to Mach number range and tunnel operational mode were factors in the design. The development process included 2D calculations for stream angle homogeneity to establish slot width and spacing, 3D calculations for verification of slot geometry and crossflow control, and experimental development of slot-baffle insert geometry that would be rugged, allow control of crossflow, and not produce strong resonant tones. results of 2D calculations, 3D calculations to illustrate need for control of crossflow, and experimental evaluation of baseline slot baffle acoustic properties are presented.
DTIC
Porosity; Walls; Slots; Wind Tunnels; Transonic Wind Tunnels; Procedures; Configuration Management

19980209734 Sverdrup Technology, Inc., Arnold AFS, TN USA
CO2 Vibrational Relaxation Effects in a Laser Heated Hypersonic Flow
Limbaugh, C. C., Sverdrup Technology, Inc., USA; Drakes, J. A., Sverdrup Technology, Inc., USA; Jun. 1997; 17p; In English; 32nd; Thermophysics Conference, 23-25 Jun. 1997, Atlanta, GA, USA
Contract(s)/Grant(s): AF Proj. 3220
Report No.(s): AD-A345777; AIAA Paper No. 97-2492; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The establishment of flow conditions characteristic of hypersonic flight in a ground test facility by conventional means requires plenum conditions that have very high temperatures and give rise to a variety of materials problems. A well-known approach to solving these problems is to use high-pressure, moderate temperature plenum conditions and add energy as the flow expands through a carefully designed nozzle. A modern approach (Radiatively Heated Wind Tunnel) uses an HF laser to excite the (02'1) mode of CO2 naturally present or added to the flow. One of the early challenges in the development will be to demonstrate the ability to add energy into the supersonic flow in a predictable and controllable manner. Consequently, a subscale experiment, the Laser Demonstration Device (LDD), is planned to investigate the transfer of laser energy to a small, expanding nozzle flow. Previous modeling of the energy transfer of the laser energy into the gas for the LDD depended on a conventional two-temperature approach to describe the internal structure of the molecules and to determine the rate coefficients. Realizing that the detailed physics of the energy transfer was important to the description of the wind tunnel performance and, hence, its viability, an effort was undertaken to compute the effect of CO2 relaxation using a technique in which the individual vibrational states are considered. Results of these computations are reported here.
DTIC
Vibration; Energy Transfer; Carbon Dioxide; Heat; Hypersonic Flow; Vibrational States; Hf Lasers; Molecular Relaxation

19980209797 Sverdrup Technology, Inc., Arnold AFS, TN USA
Investigation of Differences Between Measured and Predicted Pressures in AEDC/VKF Hypersonic Tunnel B
Maus, James R., Sverdrup Technology, Inc., USA; Jan. 1997; 13p; In English; 35th; Aerospace Sciences, 6-10 Jan. 1997, Reno, NV, USA
Report No.(s): AD-A345792; AIAA-PAPER-97-0566; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
A study has been carried out to assess the effect of flow nonuniformities in AEDC Tunnel B on surface pressures of slender bodies. The approach taken was to use flow profiles measured in a recent calibration program as inflow boundary conditions for a CFD solution to compare with the idealized case where a uniform free stream is assumed. The results of this study indicate that flow nonuniformities are at least partially responsible for discrepancies observed at low Reynolds number (Re/L = 1.0 x 10(exp 6)/ft) on slender axisymmetric bodies at zero angle of attack. There is no corresponding effect at high tunnel Reynolds number (Re/L = 3.5 x 10(exp 6)/ft). At high Reynolds number, for angles of attack that displace the nose of the vehicle more that 6-7 in. from the tunnel centerline, there is a small increase in surface pressure caused by a radial variation in Mach number.
DTIC
Computational Fluid Dynamics; Hypersonic Vehicles; Pressure; Hypersonic Wind Tunnels

19980209934 ESDU International Ltd., London, UK
Lift Curve of Wings with High-Lift Devices Deployed at Low Speeds
Jun. 1996; 24p; In English; Included in the Aerodynamics Sub-series
Report No.(s): ESDU-96003; No Copyright; Avail: Issuing Activity (ESDU International, 27 Corsham St., London, N1 6UA, UK), Hardcopy, Microfiche
Engineering Sciences Data Unit (ESDU) 96003 provides an empirical method for predicting, in two separate parts, the nonlinear lift curve up to, and including, maximum lift of aerofoils and wings with high-lift devices deployed at low speeds. The first part gives the lift curve through zero angle of attack and up to the lift coefficient at which the effects of flow breakdown start to become significant. The second part extends the lift curve up to maximum lift and includes the prediction of the angle of attack for maximum lift. The method applies to wings with aspect ratios greater than 4 and leading-edge sweeps up to about 40 degrees. Leading-edge devices considered were plain leading-edge flaps, Krueger flaps and slats of full-span and part-span extending to the wing tips. Trailing-edge flaps were split, plain, single-slotted or double-slotted. The method is expected to apply to triple-slotted flaps although no data were found to confirm that. It applies to aerofoils and so will apply well to high aspect ratio wings. For angles of attack up to that at which the effects of flow breakdown start to become significant, the lift coefficient is predicted with an rms error of 0.016. The angle of attack for maximum lift is predicted with an rms error of 0.5 degrees. Comparisons are shown of predicted and experimental results. A worked example illustrates the use of the method.
Author
Numerical Analysis; Lift; Airfoils; Leading Edge Flaps

19980209942 ESDU International Ltd., London UK
Wing Lift Coefficient Increment at Zero Angle of Attack Due to Deployment of Plain Trailing-Edge Flaps at Low Speeds
Mar. 1997; 18p; In English; Included in the Aerodynamics Sub-series
Report No.(s): ESDU-97011; No Copyright; Avail: Issuing Activity (ESDU International, 27 Corsham St., London, N1 6UA, UK), Hardcopy, Microfiche

Engineering Sciences Data Unit (ESDU) 97011 provides an empirical method that applies to full- or part-span flaps on wings. It uses the method of ESDU 94028 to establish the lift increment due to deflection of the plain flap on an aerofoil having the geometry of the wing section at flap mid-span, taken to be representative of the wing, and then applies factors to allow for planform and part-span effects. An additional factor is required that is a function of flap deflection and the angle between the aerofoil upper surface and the aerofoil datum at the trailing-edge. Sketches compare experimental results from the literature with predictions by the method for both full- and part-span flaps on swept and unswept wings and show that predictions were accurate to within 15 per cent for 98 per cent of the test data. A worked example illustrates the use of the method.
Author
Wing Flaps; Zero Angle of Attack; Trailing Edge Flaps; Numerical Analysis

19980209943 ESDU International Ltd., London, UK
Information on the Use of Data Items on High-Lift Devices
Mar. 1997; 16p; In English; Supersedes in part ESDU-75013. Included in the Aerodynamics Sub-series
Report No.(s): ESDU-97002; ESDU-75013; No Copyright; Avail: Issuing Activity (ESDU International, 27 Corsham St., London, N1 6UA, UK), Hardcopy, Microfiche
Engineering Sciences Data Unit (ESDU) 97002 is an introductory review of the methods provided in the Sub-series for the estimation of the increments in the lift, pitching moment and drag over those of the plain aerofoil or wing (in the absence of a body) at zero lift due to the deployment of high-lift leading- and/or trailing-edge devices. The methods are largely empirical, being based on extensive wind-tunnel data. The lift and pitching moment increments vary only slightly with angle of attack provided the stalled region is avoided but a method is included that predicts the lift curve to maximum lift that is significantly more realistic than the assumption of a linear variation. It is assumed that the ratio of device chord to wing chord and dimensionless wing geometry are constant spanwise. Where that is not the case, values appropriate to the mid-device span may be used to average out the effects of spanwise variations. The accuracy of the methods is discussed in the individual documents; in the absence of an explicit statement, comparisons of experimental and predicted values for increments in lift, pitching moment and profile drag coefficients suggest that errors will be within 10 per cent in most cases. All the documents contain one or more worked examples to illustrate the use of the methods. ESDU 97003 provides methods for estimating the effect of fuselage interference on the increments in lift, pitching moment and drag predicted for the isolated wing.
Author
Lift Devices; Information Resources Management; Pitching Moments; Estimating; Data Structures; Aerodynamic Drag

19980209944 ESDU International Ltd., London, UK
Subsonic and Transonic Base and Boat-Tail Pressure Drag of Cylindrical Bodies with Circular-Arc Boat-Tails
Jun. 1996; 27p; In English; Included in the Mechanisms Sub-series
Report No.(s): ESDU-96012; No Copyright; Avail: Issuing Activity (ESDU International, 27 Corsham St., London, N1 6UA, UK), Hardcopy, Microfiche
Engineering Sciences Data Unit (ESDU) 96012 provides an empirical graphical method derived from a correlation of wind-tunnel data for the prediction separately of boat-tail and base pressure drag that applies at all Mach numbers up to 1.3. The method requires that there are at least three diameters of cylindrical body upstream of the boat-tail and that there is no jet efflux or base bleed. The method for base pressure drag applies for boat-tail angles (the angle made with the base) up to 45 degrees but for boat-tail drag only for boat-tail angles up to 25 degrees for subsonic Mach numbers, 30 degrees for a Mach number of 1 and 35 degrees for supersonic Mach numbers. The method may also be used for afterbodies of parabolic profile. The total afterbody drag is the sum of the two components. The quality of fit with the experimental data is illustrated; total drag coefficient based on body maximum diameter is estimated to within 0.015. However, because of the limited sample of data, it is suggested that an accuracy of 0.03 should be allowed for. A worked example illustrates the use of the method.
Author
Supersonic Speed; Transonic Speed; Pressure Drag; Cylindrical Bodies; Procedures; Aerodynamic Drag

19980209948 ESDU International Ltd., London, UK
Drag Due to Lift for Non-Planar Swept Wings up to High Angles of Attack at Subsonic Speeds
Apr. 1997; 66p; In English; Included in the Aerodynamics Sub-series
Report No.(s): ESDU-96025; No Copyright; Avail: Issuing Activity (ESDU International, 27 Corsham St., London, N1 6UA, UK), Hardcopy, Microfiche
Engineering Sciences Data Unit (ESDU) 96025 introduces ESDUpac A9625 which provides a FORTRAN program, available on disc in the Software Volume, for the calculation of the lift and the drag due to lift for planar and non-planar wings with

a turbulent boundary layer, alone or in combination with a body. The program is designed for use on PCs with the FORTRAN 5.1 compiler. The method, fully described in ESDU 96025, applies for angles of attack for which there is leading-edge vortex flow and partial or full loss of leading-edge suction and but not widespread flow separation over the main part of the wing. The method of ESDU 95025 for planar wings has been extended to non-planar wings by using the theoretical distribution of the leading-edge suction for a planar wing of identical planform with a corrected local angle of attack deduced from a vortex lattice model. The method for calculating the attainable suction has been improved over that in ESDU 95025 and in calculating the vortex lift normal to the local surface allowance is made for the inboard migration of the leading-edge vortex. The resolved components of wing viscous axial force and of body axial and normal force are added to obtain total lift and drag due to lift. For the body contribution, the method of ESDU 90034 has been incorporated in the program with the assumption that the body can be approximated by an axisymmetric shape. The lift prediction is based on the leading-edge suction analogy and includes the non-linear contribution from leading-edge vortex flow together with the side-edge contribution. Sketches illustrate the quality of the prediction method when compared with experimental results extracted from the literature for wings with camber and twist in combination with bodies and the method predicts drag coefficient to within 0.01 of lift coefficient. The use of the program is fully described in ESDU 96025 and the input to and output from it illustrated by fully-worked examples.
Author
Lift; Swept Wings; Angle of Attack; Subsonic Speed; Aerodynamic Drag; Data Structures

19980209949 ESDU International Ltd., London, UK
Drag and Yawing Moment Due to Spoilers
Nov. 1996; 18p; In English; Included in the Aerodynamics Sub-series
Report No.(s): ESDU-96026; No Copyright; Avail: Issuing Activity (ESDU International, 27 Corsham St., London, N1 6UA, UK), Hardcopy, Microfiche

Engineering Sciences Data Unit (ESDU) 96026 provides an empirical method applying to a spoiler on one wing panel. The drag increment is considered as the sum of a profile drag component and an induced drag component which includes the effect of deploying a trailing-edge flap. The increment in yawing moment arises from the direct moment associated with the drag increment but includes an indirect effect due to the sidewash at the tail unit caused by the spoiler flow field. Comparisons are shown of the predicted results against experimental data. A worked example illustrates the use of the method.
Author
Drag; Yawing Moments; Numerical Analysis; Data Structures

19980210002 Arizona Univ., Tucson, AZ USA
Effects of Nose Radius and Aerodynamic Loading on Leading Edge Receptivity *Final Report*
Hammerton, P. W., Arizona Univ., USA; Kerschen, E. J., Arizona Univ., USA; Jul. 1998; 96p; In English
Contract(s)/Grant(s): NAG1-1135; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

An analysis is presented of the effects of airfoil thickness and mean aerodynamic loading on boundary-layer receptivity in the leading-edge region. The case of acoustic free-stream disturbances, incident on a thin cambered airfoil with a parabolic leading edge in a low Mach number flow, is considered. An asymptotic analysis based on large Reynolds number is developed, supplemented by numerical results. The airfoil thickness distribution enters the theory through a Strouhal number based on the nose radius of the airfoil, S = (omega)tau(sub n)/U, where omega is the frequency of the acoustic wave and U is the mean flow speed. The influence of mean aerodynamic loading enters through an effective angle-of-attack parameter ti, related to flow around the leading edge from the lower surface to the upper. The variation of the receptivity level is analyzed as a function of S, mu, and characteristics of the free-stream acoustic wave. For an unloaded leading edge, a finite nose radius dramatically reduces the receptivity level compared to that for a flat plate, the amplitude of the instability waves in the boundary layer being decreased by an order of magnitude when S = 0.3. Modest levels of aerodynamic loading are found to further decrease the receptivity level for the upper surface of the airfoil, while an increase in receptivity level occurs for the lower surface. For larger angles of attack close to the critical angle for boundary layer separation, a local rise in the receptivity level occurs for the upper surface, while for the lower surface the receptivity decreases. The effects of aerodynamic loading are more pronounced at larger values of S. Oblique acoustic waves produce much higher receptivity levels than acoustic waves propagating downstream parallel to the airfoil chord.
Author
Sound Waves; Radii; Effectiveness; Noses (Forebodies); Airfoil Profiles; Numerical Analysis; Aerodynamic Loads; Thin Airfoils; Leading Edges

19980210014 Institute of Theoretical and Applied Mechanics, Siberian Div., Novosibirsk Russia
Supersonic Leading Edge Receptivity
Maslov, Anatoly A., Institute of Theoretical and Applied Mechanics, Russia; Jun. 1998; 144p; In English
Contract(s)/Grant(s): NCC1-240; NCCw-74; RTOP 282-10-01-01
Report No.(s): NASA/CR-1998-208445; NAS 1.26:208445; No Copyright; Avail: CASI; A07, Hardcopy; A02, Microfiche

This paper describes experimental studies of leading edge boundary layer receptivity for imposed stream disturbances. Studies were conducted in the supersonic T-325 facility at ITAM and include data for both sharp and blunt leading edges. The data are in agreement with existing theory and should provide guidance for the development of more complete theories and numerical computations of this phenomena.
Author
Boundary Layers; Sharp Leading Edges; Data Acquisition; Wind Tunnel Tests

19980210082 ESDU International Ltd., London UK
Wing Lift Coefficient Increment at Zero Angle of Attack Due to Deployment of Trailing-Edge Split Flaps at Low Speeds
Mar. 1997; 17p; In English; Supersedes ESDU-74009. Included in the Aerodynamics Sub-series
Report No.(s): ESDU-97009; ESDU-74009; No Copyright; Avail: Issuing Activity (ESDU International, 27 Corsham St., London, N1 6UA, UK), Hardcopy, Microfiche

Engineering Sciences Data Unit (ESDU) 97009 provides an empirical method that applies to full- or part-span flaps on wings. It uses the method of ESDU 94029 to establish the lift increment due to deflection of the split flap on an aerofoil having the geometry of the wing section at flap mid-span, taken to be representative of the wing, and then applies factors to allow for planform and part-span effects. Sketches compare experimental results from the literature with predictions by the method for both full- and part-span flaps on swept and unswept wings and show that predictions were accurate to within 15 per cent for 98 per cent of the test data. A worked example illustrates the use of the method.
Author
Wing Flaps; Coefficients; Zero Angle of Attack; Aerodynamic Coefficients; Trailing Edge Flaps; Deployment; Lift

19980210219 ESDU International Ltd., London, UK
VGK Method for Two-Dimensional Aerofoil Sections, Part 2, User Manual for Operation with MS-DOS and UNIX Systems
Nov. 1996; 39p; In English; Included in the Transonic Aerodynamics Sub-series
Report No.(s): ESDU-96029; No Copyright; Avail: Issuing Activity (ESDU International, 27 Corsham St., London, N1 6UA, UK), Hardcopy, Microfiche

VGK is introduced in ESDU 96028 and is a computational fluid dynamics method coded in FORTRAN for predicting the aerodynamic characteristics of a single-element aerofoil in a subsonic freestream, including the effects of viscosity (boundary layers and wake) and shock waves. ESDU 96029 describes the use of the VGK program suite as supplied on disc running under either MS-DOS or UNIX; the source code supplied must be compiled under FORTRAN 77. Sufficient information is given to enable results to be obtained, but ESDU 96028 should be referred to for the principles and performance of the method, so that the results obtained may be properly assessed. Typical computing time for a single run of VGK using a 80486 DX processor is 90 seconds and using a Pentium processor is 30 seconds. The disc containing the files relating to VGK also contains a 'library' of files of aerofoil coordinates. Because of its good performance, VGK can be utilized effectively to investigate a number of factors, such as: the influence of aerofoil geometry (profile and camber) changes on aerofoil characteristics at and around cruise conditions; the influence of changes in Mach number, Reynolds number and transition locations on aerofoil characteristics; the influence of deflection through small angles of leading- and/or trailing-edge flaps; the influence of over-fixing transition in wind-tunnel tests on aerofoils.
Author
Procedures; Two Dimensional Bodies; Airfoil Profiles; Computational Fluid Dynamics; Aerodynamic Characteristics

19980210220 ESDU International Ltd., London, UK
Response of Structures to Vortex Shedding. Structures of Circular or Polygonal Cross Section
Dec. 1996; 80p; In English; Included in the Wind Engineering Sub-series
Report No.(s): ESDU-96030; No Copyright; Avail: Issuing Activity (ESDU International, 27 Corsham St., London, N1 6UA, UK), Hardcopy, Microfiche

Engineering Sciences Data Unit (ESDU) 96030 describes the nature of the lateral response to vortex shedding of structures of circular or of polygonal cross section with more than eight sides. A method is developed for calculation of this response together

with the data required to implement it. It takes account of the response to buffeting by across-wind atmospheric turbulence components, using the methods of ESDU 89049. Comparisons of predictions with both model and full-scale measurements, and a discussion of methods of reducing response to vortex shedding are included. ESDU 96031 introduces a program running in Excel that implements the method. The method treats the following conditions: structures that are parallel-sided, tapered and stepped with smooth or rough surfaces (if ancillary structures are attached such as ladders they must be entirely in the main structure wake for the method to apply), cantilevered or between end fixings, vertical, horizontal or inclined in flow that is uniform or shear, smooth or turbulent, with natural atmospheric turbulence or simulated turbulence as in a wind-tunnel.
Author
Vortex Shedding; Circular Plates; Polygons; Procedures; Geometry

19980210221 ESDU International Ltd., London, UK
Computer Programs for Response of Structures to Vortex Shedding, Part 1, Microsoft Excel Module
Dec. 1996; 23p; In English; Included in the Wind Engineering Sub-series
Report No.(s): ESDU-96031; No Copyright; Avail: Issuing Activity (ESDU International, 27 Corsham St., London, N1 6UA, UK), Hardcopy, Microfiche

Engineering Sciences Data Unit (ESDU) 96031 introduces a program for calculating the lateral response to vortex shedding of structures of circular or of polygonal section of more than eight sides. It includes the lateral response to buffeting by the across-wind components of atmospheric turbulence. The basis of the method is described in ESDU 96030 which should be consulted for details of applicability. ESDU 96031 provides guidance on the use of the Excel module, explaining the format of the input and output. Several worked examples are included to illustrate the use of the method.
Author
Computer Programs; Vortex Shedding; Circular Plates; Polygons

19980210222 ESDU International Ltd., London, UK
Wing Lift Coefficient Increment at Zero Angle of Attack due to Deployment of Leading-Edge Devices at Low Speeds
Nov. 1996; 19p; In English; Included in the Aerodynamics Sub-series
Report No.(s): ESDU-96032; No Copyright; Avail: Issuing Activity (ESDU International, 27 Corsham St., London, N1 6UA, UK), Hardcopy, Microfiche

Engineering Sciences Data Unit (ESDU) 96032 provides an empirical method developed from that for aerofoil sections in ESDU 94027 to 94031. It applies to leading-edge flaps, drooped leading edges, slats and vented Krueger flaps, and sealed slats and Krueger flaps. For wings with full-span leading-edge devices a factor, dependent on planform geometry, is applied to allow for three-dimensional effects. For part-span leading-edge devices, additional factors are introduced dependent on the device and wing geometry. The method applies for leading-edge sweep less than 47 degrees and Reynolds numbers based on aerodynamic mean chord greater than 0.6E-6. The experimental data are predicted to within 0.02 in lift coefficient based on wing area. A worked example illustrates the use of the data.
Author
Zero Angle of Attack; Wings; Lift; Aerodynamic Coefficients; Leading Edge Sweep; Airfoil Profiles

19980210225 ESDU International Ltd., London, UK
Estimation of the Unsteady Lift Coefficient of Subsonic Propeller Blades in Non-Axial Inflow
Nov. 1996; 11p; In English; Included in the Noise Sub-series
Report No.(s): ESDU-96027; No Copyright; Avail: Issuing Activity (ESDU International, 27 Corsham St., London, N1 6UA, UK), Hardcopy, Microfiche

Engineering Sciences Data Unit (ESDU) 96027 provides a program for calculating the unsteady local lift coefficient on an aerofoil section of the blade in subcritical flow. This forms part of the data input required by the propeller noise prediction program introduced in ESDU 95029. The orientation of the propeller axis is described by the Euler angles of yaw and pitch relative to the flight axis. The method is applicable to an aircraft on a straight, steady flight path that need not be horizontal. The program, known as ESDUpac A9627, is written in FORTRAN 77. It is provided on disc in the software volume, uncompiled and compiled within ESDUview, a user-friendly interface that prompts on-screen for input data. The input format is explained and a worked example illustrates the format of the output data.
Author
Estimates; Unsteady State; Dynamic Characteristics; Lift; Airfoil Profiles; Data Structures

19980210226 ESDU International Ltd., London, UK
VGK Method for Two-Dimensional Aerofoil Sections, Part 1, Principles and Results
Nov. 1996; 84p; In English; Included in the Transonic Aerodynamics Sub-series
Report No.(s): ESDU-96028; No Copyright; Avail: Abstract Only (ESDU International, 27 Corsham St., London, N1 6UA, UK), Hardcopy, Microfiche

VGK is a computational fluid dynamics method coded in FORTRAN for predicting the aerodynamic characteristics of single-element aerofoils in a subsonic freestream, including the effects of viscosity (boundary layers and wake) and shock waves. VGK uses an iterative approach to solve coupled finite-difference equations for the inviscid flow region (assumed to be potential) and the viscous flow region (represented by integral equations). The aerofoil boundary-layers must be attached. VGK was developed at RAE (now DERA), Farnborough) and Crown copyright is retained in the source code. ESDU 96028 describes the main features of the VGK method, including the inviscid and viscous flow elements, the computational grids, and the solution process. The precise forms of finite-difference scheme and iteration procedure employed in a particular VGK ,run' are governed by a number of parameters whose values may be selected by the user. Default values for them are given, together with comments on the effects on VGK results of variations from those values. The accuracy of results from VGK is considered both for inviscid flows, where comparisons with other theoretical methods are given, and for viscous flows, where comparisons with experiment are presented. For flows where the boundary layer is attached and any shock waves are relatively weak (which thus include most aerofoil design conditions) the performance of VGK is good, with drag coefficient being well predicted. Where the boundary layer is locally separated or close to separation, VGK can still give a valuable indication of the flow parameters, but its accuracy is then not as good. Because of its good performance, VGK can be utilized effectively to investigate a number of factors, such as: the influence of aerofoil geometry (profile and camber) changes on aerofoil characteristics at and around cruise conditions; the influence of changes in Mach number, Reynolds number and transition locations on aerofoil characteristics; the influence of deflection through small angles of leading- and/or trailing-edge flaps; the influence of over-fixing transition in wind-tunnel tests on aerofoils.
Author

Airfoil Profiles; Two Dimensional Models; Computational Fluid Dynamics; FORTRAN; Computer Programs; Computational Grids; Aerodynamic Characteristics

19980210231 ESDU International Ltd., London, UK
Effect of Stabilising Fins on Base Drag of Cylindrical Bodies at Supersonic Speeds
Aug. 1997; 12p; In English; Included in the Aerodynamics Sub-series
Report No.(s): ESDU-97022; No Copyright; Avail: Issuing Activity (ESDU International, 27 Corsham St., London, N1 6UA, UK), Hardcopy, Microfiche

Engineering Sciences Data Unit (ESDU) 97022 gives a method for estimating the increment in (jet off) base drag, over that for the body alone given by ESDU 79022, due to stabilising fins on axisymmetric cylindrical bodies at zero angle of attack with a turbulent boundary layer at Mach numbers from 1.5 to 5. It is based on a simple theoretical model modified with an empirical factor to fit wind-tunnel data and was derived for cruciform or planar fins mounted with trailing-edges flush with the base or upstream of the base. It may be applied to up to six equally-spaced fins. The fins tested were of circular-arc or diamond section with maximum thickness at mid-chord but the method can be applied to other configurations. The method requires at least three body diameters of cylindrical body length upstream of the fins to ensure there is no forebody/fin interference. Sketches compare the predictions with the experimental results and show the increment is predicted to within 0.01 in base drag coefficient based on base area. Details of geometries used in the correlation are provided, and a fully worked example illustrates the use of the method.
Author

Stabilization; Fins; Cylindrical Bodies; Procedures; Estimating; Supersonic Speed; Aerodynamic Coefficients; Aerodynamic Drag

19980210290 NASA Lewis Research Center, Cleveland, OH USA
Transmission and Incidence Losses for a Slotted Plate
Wilson, Jack, NYMA, Inc., USA; Chima, Rodrick V., NASA Lewis Research Center, USA; Skews, Beric W., Witwatersrand Univ., South Africa; Jun. 1998; 14p; In English; 34th; Joint Propulsion Conference and Exhibit, 13-15 Jul. 1998, Cleveland, OH, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA
Contract(s)/Grant(s): NAS3-27186; RTOP 523-26-13
Report No.(s): NASA/TM-1998-207420; NAS 1.15:207420; E-11175; AIAA Paper 98-3252; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The objective of this work is to find a model of the stagnation pressure loss resulting from flow through a slotted plate, which is effectively a cascade of flat plate airfoils, particularly at very large angles of incidence. Data from a published experiment is examined, and compared with control volume analysis, and CFD code calculations. An assumption that the loss can be separated into a transmission loss and an incidence loss seems to be justified by the data. Both the data and the CFD code results are consistent with an incidence loss model in which the flow component normal to the slot axis is lost. However, the experimental transmission loss is much larger than calculated values.
Author
Flat Plates; Slots; Transmission Loss; Models

19980210402 NASA Marshall Space Flight Center, Huntsville, AL USA
Comparison of the Aerodynamic Characteristics of Similar Models in Two Size Wind Tunnels at Transonic Speeds
Springer, Anthony M., NASA Marshall Space Flight Center, USA; 1998; 24p; In English; 7th; Thermophysics and Heat Transfer, 15-18 Jun. 1998, Albuquerque, NM, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA
Report No.(s): NASA/TM-1998-208264; NAS 1.15:208264; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
The aerodynamic characteristics of two similar models of a lifting body configuration were run in two transonic wind tunnels, one a 16 foot the other a 14-inch and are compared. The 16 foot test used a 2% model while the 14-inch test used a 0.7% scale model. The wind tunnel model configurations varied only in vertical tail size and an aft sting shroud. The results from these two tests compare the effect of tunnel size, Reynolds number, dynamic pressure and blockage on the longitudinal aerodynamic characteristics of the vehicle. The data accuracy and uncertainty are also presented. It was concluded from these tests that the data resultant from a small wind tunnel compares very well to that of a much larger wind tunnel in relation to total vehicle aerodynamic characteristics.
Author
Wind Tunnel Models; Transonic Speed; Aerodynamic Characteristics; Scale Models

19980210559 Georgia Inst. of Tech., School of Aerospace Engineering, Atlanta, GA USA
Low Speed Aerodynamics of the X-38 CRV ***Final Report, May 1997 - Apr. 1998***
Komerath, N. M., Georgia Inst. of Tech., USA; Funk, R., Georgia Inst. of Tech., USA; Ames, R. G., Georgia Inst. of Tech., USA; Mahalingam, R., Georgia Inst. of Tech., USA; Matos, C., Georgia Inst. of Tech., USA; Jun. 1998; 5p; In English
Contract(s)/Grant(s): NAG9-927
Report No.(s): NASA/CR-1998-208293; NAS 1.26:208293; GITAER-EAG-98-03; E16-N63; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche
This project was performed in support of the engineering development of the NASA X-38 Crew Return Vehicle (CRV)system. Wind tunnel experiments were used to visualize various aerodynamic phenomena encountered by the CRV during the final stages of descent and landing. Scale models of the CRV were used to visualize vortex structures above and below the vehicle, and in its wake, and to quantify their trajectories. The effect of flaperon deflection on these structures was studied. The structure and dynamics of the CRV's wake during the drag parachute deployment stage were measured. Regions of high vorticity were identified using surveys conducted in several planes using a vortex meter. Periodic shedding of the vortex sheets from the sides of the CRV was observed using laser sheet videography as the CRV reached high angles of attack during the quasi-steady pitch-up prior to parafoil deployment. Using spectral analysis of hot-film anemometer data, the Strouhal number of these wake fluctuations was found to be 0.14 based on the model span. Phenomena encountered in flight test during parafoil operation were captured in scale-model tests, and a video photogrammetry technique was implemented to obtain parafoil surface shapes during flight in the tunnel. Forces on the parafoil were resolved using tension gages on individual lines. The temporal evolution of the phenomenon of leading edge collapse was captured. Laser velocimetry was used to demonstrate measurement of the porosity of the parafoil surface. From these measurements, several physical explanations have been developed for phenomena observed at various stages of the X-38 development program. Quantitative measurement capabilities have also been demonstrated for continued refinement of the aerodynamic technologies employed in the X-38 project. Detailed results from these studies are given in an AIAA Paper, two slide presentations, and other material which are given on a Web-based archival resource. This is the Digital Library of the Georgia Tech Experimental Aerodynamics Group.
Author
Low Speed; Return to Earth Space Flight; Aerodynamic Characteristics; Wind Tunnel Tests; Imaging Techniques; Scale Models; Video Data

19980210597 NASA Lewis Research Center, Cleveland, OH USA
Study of Low Reynolds Number Effects on the Losses in Low-Pressure Turbine Blade Rows
Ashpis, David E., NASA Lewis Research Center, USA; Dorney, Daniel J., General Motors Inst., USA; Jun. 1998; 22p; In English; 34th; Joint Propulsion Conference and Exhibit, 12-15 Jul. 1998, Cleveland, OH, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA
Contract(s)/Grant(s): NAG3-1668; RTOP 522-31-23
Report No.(s): NASA/TM-1998-207919; NAS 1.15:207919; AIAA Paper 98-3575; E-11202; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Experimental data from jet-engine tests have indicated that unsteady blade row interactions and separation can have a significant impact on the efficiency of low-pressure turbine stages. Measured turbine efficiencies at takeoff can be as much as two points higher than those at cruise conditions. Several recent studies have revealed that Reynolds number effects may contribute to the lower efficiencies at cruise conditions. In the current study numerical experiments have been performed to study the models available for low Reynolds number flows, and to quantify the Reynolds number dependence of low-pressure turbine cascades and stages. The predicted aerodynamic results exhibit good agreement with design data.
Author
Low Reynolds Number; Turbine Blades; Turbines; Engine Tests; Turbomachinery; Turbulence

03
AIR TRANSPORTATION AND SAFETY

Includes passenger and cargo air transport operations; and aircraft accidents.

19980206509 Federal Aviation Administration, Office of Aviation Research, Washington, DC USA
Federal Aviation Administration Plan for Research, Engineering and Development, 1998: Report to the USA Congress
Feb. 1998; 183p; In English
Report No.(s): AD-A344936; No Copyright; Avail: CASI; A09, Hardcopy; A02, Microfiche

This report contains plans for research and development within the FAA for 1998. Partial contents include: Objectives, aviation community initiatives, long-term research, and program area descriptions of air traffic services, airports technology, aircraft safety, aviation security, human factors and aviation medicine, environment and energy, and R,E & D program management.
DTIC
Civil Aviation; Research Management; Research and Development; Congressional Reports; Safety Factors; Aircraft Safety; Security

19980206792 National Transportation Safety Board, Washington, DC USA
National Transportation Safety Board Transportation Initial Decisions and Orders and Board Opinions and Orders, ***Apr. 1998***
Apr. 1998; 290p; In English
Report No.(s): PB98-916704; NTSB/IDBOO-98/04; No Copyright; Avail: CASI; A13, Hardcopy; A03, Microfiche

This publication contains all Judge Initial Decisions and Board Opinions and Orders in Safety Enforcement and Seaman Enforcement Cases for April 1998.
NTIS
Air Transportation; Accident Prevention

19980209677 General Accounting Office, National Security and International Div., Washington, DC USA
Report to the Honorable John McCain, US Senate. Intratheater Airlift: Information on the Air Force's C-130 Aircraft
Apr. 1998; 36p; In English
Report No.(s): GAO/NSIAD-98-108; B-274598; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The C-130 Hercules aircraft is a medium-range, tactical airlift aircraft designed primarily for transporting personnel and cargo. The aircraft was originally flown in 1954 and has been under continuous production ever since. The Air Force currently has approximately 700 C-130s of various configurations in its current C-130E and H fleet. The average age of the active duty C-130 fleet is over 25 years old, while the average age of the Guard and Reserve C-130s is about 15 years old. These aircraft are under the management and control of the Air Mobility Command (Amc)l and are operated by the active Air Force, the Air National Guard, and the Air Force Reserve. The Air Force has just begun buying a new J model C-130. Lockheed Martin Corporation is developing the J aircraft as a commercial venture and expects it to (1) lower the cost of ownership of the fleet and (2) climb higher

and faster, fly at higher cruise speeds, and take off and land in a shorter distance than the existing fleet. The J will have the same structural characteristics as previous C-130 models; however, it differs in that it includes, among other things, an advanced integrated digital avionics systems, a new engine and composite propellers, a heads-up display, and a redesigned flight station to facilitate operation by a three-man versus a five-man crew.
Derived from text
Congressional Reports; Air Transportation; C-130 Aircraft; Structural Design; Flight Operations; Cost Reduction; Armed Forces (USA)

19980210315 Brookhaven National Lab., Upton, NY USA
On the safety of aircraft systems: A case study
Martinez–Guridi, G., Brookhaven National Lab., USA; Hall, R. E., Brookhaven National Lab., USA; Fullwood, R. R., Brookhaven National Lab., USA; May 14, 1997; 45p; In English
Contract(s)/Grant(s): DE-AC02-76CH-00016; 95-G-039
Report No.(s): BNL-64946; DE98-002766; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

An airplane is a highly engineered system incorporating control- and feedback-loops which often, and realistically, are non-linear because the equations describing such feedback contain products of state variables, trigonometric or square-root functions, or other types of non-linear terms. The feedback provided by the pilot (crew) of the airplane also is typically non-linear because it has the same mathematical characteristics. An airplane is designed with systems to prevent and mitigate undesired events. If an undesired triggering event occurs, an accident may process in different ways depending on the effectiveness of such systems. In addition, the progression of some accidents requires that the operating crew take corrective action(s), which may modify the configuration of some systems. The safety assessment of an aircraft system typically is carried out using ARP (Aerospace Recommended Practice) 4761 (SAE, 1995) methods, such as Fault Tree Analysis (FTA) and Failure Mode and Effects Analysis (FMEA). Such methods may be called static because they model an aircraft system on its nominal configuration during a mission time, but they do not incorporate the action(s) taken by the operating crew, nor the dynamic behavior (non-linearities) of the system (airplane) as a function of time. Probabilistic Safety Assessment (PSA), also known as Probabilistic Risk Assessment (PRA), has been applied to highly engineered systems, such as aircraft and nuclear power plants. PSA encompasses a wide variety of methods, including event tree analysis (ETA), FTA, and common-cause analysis, among others. PSA should not be confused with ARP 4761's proposed PSSA (Preliminary System Safety Assessment); as its name implies, PSSA is a preliminary assessment at the system level consisting of FTA and FMEA.
DOE
Failure Analysis; Safety Factors; Feedback Control; Aeronautics

19980210764 NASA Ames Research Center, Moffett Field, CA USA
Dynamic Density: An Air Traffic Management Metric
Laudeman, I. V., NASA Ames Research Center, USA; Shelden, S. G., San Jose State Univ., USA; Branstrom, R., San Jose State Univ., USA; Brasil, C. L., San Jose State Univ., USA; Apr. 1998; 8p; In English
Contract(s)/Grant(s): RTOP 538-18-22
Report No.(s): NASA/TM-1998-112226; NAS 1.15:112226; A-98-10366; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

The definition of a metric of air traffic controller workload based on air traffic characteristics is essential to the development of both air traffic management automation and air traffic procedures. Dynamic density is a proposed concept for a metric that includes both traffic density (a count of aircraft in a volume of airspace) and traffic complexity (a measure of the complexity of the air traffic in a volume of airspace). It was hypothesized that a metric that includes terms that capture air traffic complexity will be a better measure of air traffic controller workload than current measures based only on traffic density. A weighted linear dynamic density function was developed and validated operationally. The proposed dynamic density function includes a traffic density term and eight traffic complexity terms. A unit-weighted dynamic density function was able to account for an average of 22% of the variance in observed controller activity not accounted for by traffic density alone. A comparative analysis of unit weights, subjective weights, and regression weights for the terms in the dynamic density equation was conducted. The best predictor of controller activity was the dynamic density equation with regression-weighted complexity terms.
Author
Air Traffic Controllers (Personnel); Air Traffic Control; Air Traffic; Aircraft Safety; Approach Control

04
AIRCRAFT COMMUNICATIONS AND NAVIGATION

Includes digital and voice communication with aircraft; air navigation systems (satellite and ground based); and air traffic control.

19980209675 Defence Science and Technology Organisation, Electronics and Surveillance Research Lab., Salisbury, Australia
Ionospheric Effects on Global Positioning System Receivers
Knight, Mark F., Defence Science and Technology Organisation, Australia; Finn, Anthony, Defence Science and Technology Organisation, Australia; Cerera, Manuel, Defence Science and Technology Organisation, Australia; Feb. 1998; 94p; In English
Report No.(s): DSTO-RR-0121; AR-010-444; Copyright; Avail: Issuing Activity (DSTO Electronics and Surveillance Research Lab., PO Box 1500, Salisbury, Australia); US Sales Only, Hardcopy, Microfiche

This report presents the results of a study conducted under tasks ADL 94/373 and ADA 96/005 into the effects of the ionosphere on Global Positioning System (GPS) receivers. The report focuses on the effects of the disturbed ionosphere on GPS as this phenomenon has the capacity to degrade the accuracy and reliability of both civilian and military GPS receivers. The impact of ionospheric disturbances on the susceptibility of GPS in a potentially hostile electromagnetic environment is also discussed.
Author
Ionospheric Disturbances; Global Positioning System; Data Acquisition

19980209720 Naval Postgraduate School, Monterey, CA USA
Integration of a Multi-Rate Position Filter in the Navigation System of an Unmanned Aerial Vehicle (UAV) for Precise Navigation in the Local Tangent Plane (LTP)
Perry, Robert C., Naval Postgraduate School, USA; Mar. 1998; 74p; In English
Report No.(s): AD-A346060; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

Differential Global Positioning System (DGPS) provides highly accurate position information, but at update rates of one Hz which is inadequate for precise aircraft terminal maneuvering such as take off and landing. During this period between updates an accurate position estimate in Local Tangent Plane (LTP) can be made using complementary filtering of the DGPS position and indicated airspeed. Use of indicated airspeed as the filter velocity input necessitates the transformation from body to inertial (LTP) reference frame using Euler angle information available from the Inertial Measuring Unit (IMU) or DGPS. This filter provides accurate estimates of both vehicle position and existing wind. These filter outputs of position and wind can then be used as inputs to a trajectory controller to ultimately enable autonomous launch and recovery of an Unmanned Aerial Vehicle.
DTIC
Aircraft Maneuvers; Flight Tests; Inertial Navigation; Pilotless Aircraft; Navigation Instruments; Digital Filters

19980210598 NASA Langley Research Center, Hampton, VA USA
Flight Evaluation of Center-TRACON Automation System Trajectory Prediction Process
Williams, David H., NASA Langley Research Center, USA; Green, Steven M., NASA Ames Research Center, USA; Jul. 1998; 86p; In English
Contract(s)/Grant(s): RTOP 538-04-11-16
Report No.(s): NASA/TP-1998-208439; L-17644; NAS 1.60:208439; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

Two flight experiments (Phase 1 in October 1992 and Phase 2 in September 1994) were conducted to evaluate the accuracy of the Center-TRACON Automation System (CTAS) trajectory prediction process. The Transport Systems Research Vehicle (TSRV) Boeing 737 based at Langley Research Center flew 57 arrival trajectories that included cruise and descent segments; at the same time, descent clearance advisories from CTAS were followed. Actual trajectories of the airplane were compared with the trajectories predicted by the CTAS trajectory synthesis algorithms and airplane Flight Management System (FMS). Trajectory prediction accuracy was evaluated over several levels of cockpit automation that ranged from a conventional cockpit to performance-based FMS vertical navigation (VNAV). Error sources and their magnitudes were identified and measured from the flight data. The major source of error during these tests was found to be the predicted winds aloft used by CTAS. The most significant effect related to flight guidance was the cross-track and turn-overshoot errors associated with conventional VOR guidance. FMS lateral navigation (LNAV) guidance significantly reduced both the cross-track and turn-overshoot error. Pilot procedures and VNAV guidance were found to significantly reduce the vertical profile errors associated with atmospheric and airplane performance model errors.
Author
Air Traffic Control; VHF Omnirange Navigation; Transport Vehicles; Management Systems; Flight Tests; Flight Management Systems; Automatic Control; Aircraft Performance

19980210625 Ohio Univ., Avionics Engineering Center, Athens, OH USA
Defining the ATC Controller Interface for Data Link Clearances *Final Report, 1 Oct. 1996 - 31 Oct. 1997*
Rankin, James, Ohio Univ., USA; 1998; 7p; In English
Contract(s)/Grant(s): NAG1-1788
Report No.(s): NASA/CR-1998-208288; NAS 1.26:208288; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

The Controller Interface (CI) is the primary method for Air Traffic Controllers to communicate with aircraft via Controller-Pilot Data Link Communications (CPDLC). The controller, wearing a microphone/headset, aurally gives instructions to aircraft as he/she would with today's voice radio systems. The CI's voice recognition system converts the instructions to digitized messages that are formatted according to the RTCA DO-219 Operational Performance Standards for ATC Two-Way Data Link Communications. The DO-219 messages are transferred via RS-232 to the ATIDS system for uplink using a Mode-S datalink. Pilot acknowledgments of controller messages are downlinked to the ATIDS system and transferred to the Cl. A computer monitor is used to convey information to the controller. Aircraft data from the ARTS database are displayed on flight strips. The flight strips are electronic versions of the strips currently used in the ATC system. Outgoing controller messages cause the respective strip to change color to indicate an unacknowledged transmission. The message text is shown on the flight strips for reference. When the pilot acknowledges the message, the strip returns to its normal color. A map of the airport can also be displayed on the monitor. In addition to voice recognition, the controller can enter messages using the monitor's touch screen or by mouse/keyboard.
Derived from text
Air Traffic Control; Data Bases; Data Links; Monitors

19980210664 Genoa Univ., Dept. of Biophysical and Electronic Engineering, Genoa, Italy
A KF-Based Integration System for Land Vehicle Tracking From Real DGPS and INS Data
Regazzoni, Carlo S., Genoa Univ., Italy; Teschioni, Andrea, Genoa Univ., Italy; Tacconi, Giorgio, Genoa Univ., Italy; Apr. 1998; 12p; In English; Also announced as 19980210650; Copyright Waived; Avail: CASI; A03, Hardcopy; A04, Microfiche

The present work is addressed to perform an estimation in an accurate and robust way of the trajectory of a land vehicle by using a Differential Global Positioning System (DGPS) and an Inertial System (INS). The use of a Kalman Filter (KF) approach for integration, data-fusion and estimation tasks has been proved as able to providing precise and robust evaluation of cinematic variables (linear position and velocity) even in the case of long missions or under critical conditions of temporary incompleteness or unreliability of part of the acquired data. From the state of the art, it can be seen that the DGPS is very precise sensor providing 3D geographic position, but present low output rate and temporary signal loss or accuracy degradation, while the INS provides continuous outputs of rotation angles and linear acceleration with high output rate but the inertial units have burdensome intrinsic errors which bring about a degradation of precision increasing with time. Practically,the integration of DGPS and INS is forecast to provide continuous estimates over time, corrupted by small and almost unchanging errors. The system has been tested over an extensive set of real data providing good results both in precision and in robustness.
Author
Global Positioning System; Kalman Filters; Multisensor Fusion; Remote Sensing; Multisensor Applications

05
AIRCRAFT DESIGN, TESTING AND PERFORMANCE

Includes aircraft simulation technology.

19980206537 Sandia National Labs., Albuquerque, NM USA
FAA fluorescent penetrant activities
Moore, D. G., Sandia National Labs., USA; Larson, B. F., Iowa State Univ. of Science and Technology, USA; [1997]; 4p; In English; 1997 Asnt Fall Conference: Ndt - Keystone of Quality, 20 - 24 Oct. 1997, Pittsburgh, PA, USA
Contract(s)/Grant(s): DE-AC04-94AL-85000
Report No.(s): SAND-97-2596C; CONF-971093-; DE98-001188; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

The Federal Aviation Administration's Airworthiness Assurance NDI Validation Center (AANC) and the Center for Aviation Systems Reliability (CASR) are currently working to develop a liquid penetrant inspection (LPI) system evaluation capability that will support the needs of the penetrant manufacturers, commercial airline industry and the FAA. The main focus of this facility is to support the evaluation of penetrant inspection materials, penetrant systems and to apply resources to support industry needs.

This paper discusses efforts to create such a facility and an initial project to produce fatigue crack specimens for evaluation of Type 1 penetrant sensitivities.
DOE
Fluorescence; Penetrants; Inspection; Systems Analysis; Reliability

19980206538 Sandia National Labs., Albuquerque, NM USA
Low-voltage radiography on aircraft composite doublers
Moore, D. G., Sandia National Labs., USA; Murray, J. D., Sandia National Labs., USA; [1997]; 4p; In English; 1997 ASNT Fall Conference: Ndt - Keystone of Quality, 20 - 24 Oct. 1997, Pittsburgh, PA, USA
Contract(s)/Grant(s): DE-AC04-94AL-85000
Report No.(s): SAND-97-2597C; CONF-971093-; DE98-001187; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

Composite doublers are gaining popularity for their ability to repair and reinforce commercial aircraft structures and it is anticipated that the potential cost savings may spur wider use of this technology. But before composite doublers can be accepted by the civil aviation industry, inspection techniques must be developed to verify the integrity of the doubler and the parent material under the doubler. The Federal Aviation Administration Airworthiness Assurance NDI Validation Center (AANC) is currently developing test methods to inspect aircraft structures under composite doublers using low kilovoltage radiography. This paper documents the radiographic techniques developed by the AANC which have been found to give the best contrast of the radiographic image with reduced image distortion.
DOE
Aircraft Industry; Aircraft Reliability; Aircraft Structures; Civil Aviation; Cost Reduction; Low Voltage; Composite Materials

19980206637 Naval Postgraduate School, Monterey, CA USA
Development of Graphical User Interface (GUI) for Joint Army/Navy Rotorcraft Analysis and Design (JANRAD) Software
Lapacik, Chris F., Naval Postgraduate School, USA; Mar. 1998; 207p; In English
Report No.(s): AD-A345931; No Copyright; Avail: CASI; A10, Hardcopy; A03, Microfiche

A Graphical User Interface (Gul) was developed and implemented as the front end of the NPS software Joint Army/Navy Rotorcraft Analysis and Design (JANRAD). The original JANRAD computer program was developed to aid in the analysis of helicopter rotor performance, stability and control and rotor dynamics. An interactive program, JANRAD was capable of accurately and quickly solving helicopter design problems at the preliminary design level. The addition of the Gul greatly simplified the use of the program but added considerable complexity to the original MATLAB M-File code. Because of the increased complexity, only the Performance Analysis module of the program was modified. The use of several new features of MATLAB version 5.1, such as the GUIDE and Structure functions, simplified the construction of the Gul environment and enhanced the tie between the user interface and performance calculation routines.
DTIC
Graphical User Interface; Rotary Wings; Rotary Wing Aircraft; Design Analysis; Helicopter Design; Human-Computer Interface

19980209941 ESDU International Ltd., London UK
Static Aeroelasticity: A Formal Analysis Using Assumed Modes
Dec. 1997; 48p; In English; Included in the Dynamics Sub-series
Report No.(s): ESDU-97032; No Copyright; Avail: Issuing Activity (ESDU International, 27 Corsham St., London, N1 6UA, UK), Hardcopy, Microfiche

Engineering Sciences Data Unit (ESDU) 97032 gives a formal analysis of the equilibrium behaviour of a flexible aeroplane of classical configuration in trim or in a quasi-steady pull-out maneuver. The aeroplane has a swept wing and tailplane, both flexible in bending and torsion about straight flexural axes, a rigid fuselage, and wing-mounted rigid nacelles. Two structural configurations are considered: with the wing and tailplane ribs normal to the swept flexural axis and with them aligned to the freestream direction. The bending and twist distributions of the wing and tailplane are assumed to be the sum of a set of individual modes, each mode consisting of an amplitude multiplied by its spanwise shape. The mode shapes used are an orthogonal set that satisfy the boundary conditions for a uniform elastic beam built-in at its root, taken here to be normal to the swept flexural axis. Expressions for overall static stability, given by the elevator trim margin, for static stability at constant speed, given by the elevator maneuver trim margin, and for aeroelastic static stability, are provided. The coefficients are given of the set of simultaneous equa-

tions that determine the unknown variables (incidence, elevator deflection, and wing and tailplane bending and twist deformations) in terms of speed and normal acceleration for the configuration with ribs normal to the relevant flexural axis.
Author
Aeroelasticity; Static Stability; Equilibrium Methods; Horizontal Tail Surfaces; Aerodynamic Stability; Data Structures

19980210223 ESDU International Ltd., London, UK
A Qualitative Introduction to Static Aeroelasticity: Controllability, Loads and Stability
Dec. 1996; 59p; In English; Included in the Dynamics Sub-series
Report No.(s): ESDU-96037; No Copyright; Avail: Issuing Activity (ESDU International, 27 Corsham St., London, N1 6UA, UK), Hardcopy, Microfiche

Engineering Sciences Data Unit (ESDU) 96037 introduces some of the fundamental concepts relating to the effects of structural flexibility for aeroplanes of classical configuration (aspect ratios greater than 4 and sweep angles less than 35 degrees) in wholly subsonic flow either in steady flight or in a quasi-steady pull-out maneuver. Bending and twist deformations of the wing and tailplane are assumed to occur only in the spanwise direction about a straight elastic or flexural axis; chordwise deformations are ignored. Weight distribution changes due to deformation are neglected. In trimmed level flight expressions are developed for aeroplane incidence, elevator angle to trim and elevator trim margin. The steady pull-out maneuver is treated as a quasi-steady perturbation superimposed on the steady level trimmed state and expressions are developed for aeroplane maneuver incidence, elevator maneuver angle and elevator maneuver margin. An elevator trim divergence speed is found to depend on tailplane torsional stiffness and pitching moment due to elevator deflection and is unchanged for maneuvering flight. Finally, stability is considered in terms of overall static stability, constant speed static stability and overall structural mode static stability.
Author
Aeroelasticity; Static Stability; Loads (Forces); Structural Stability; Flexibility; Aerodynamic Balance; Aerodynamic Characteristics

19980210235 ESDU International Ltd., London UK
Similarity Rules for Application in Aircraft Performance Work
Sep. 1997; 12p; In English; Included in the Aircraft Performance Sub-series
Report No.(s): ESDU-97025; No Copyright; Avail: Issuing Activity (ESDU International, 27 Corsham St., London, N1 6UA, UK), Hardcopy, Microfiche

Engineering Sciences Data Unit (ESDU) 97025 gives similarity rules for pressure coefficient. For subsonic and supersonic two- and three-dimensional flow over thin sections and for axisymmetric flow they are derived from linearized (potential) flow equations. For transonic flow they are derived from a non-linear equation for two- and three-dimensional flow only and no treatment for axisymmetric flow is given. Manipulation of the two-dimensional transonic rule to forms more readily applicable is illustrated. Such rules are valuable in providing a simple theoretical framework within which to work when formulating generalised databases from ad hoc experimental data. The application of the rules to drag, lift and pitching moment coefficients is shown. to illustrate the value of the rules, they are applied in an illustrative example to correlate sets of experimental results for the pressure drag of a wedge in both subsonic and supersonic flow, collapsing the data into a family of curves well.
Author
Aircraft Performance; Pressure Ratio; Subsonic Flow; Three Dimensional Flow; Supersonic Flow; Aerodynamic Coefficients

19980210397 NASA Langley Research Center, Hampton, VA USA
Aerodynamic Parameters of High Performance Aircraft Estimated from Wind Tunnel and Flight Test Data
Klein, Vladislav, George Washington Univ., USA; Murphy, Patrick C., NASA Langley Research Center, USA; 1998; 20p; In English
Report No.(s): NASA/TM-1997-207993; NAS 1.15:207993; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

A concept of system identification applied to high performance aircraft is introduced followed by a discussion on the identification methodology. Special emphasis is given to model postulation using time invariant and time dependent aerodynamic parameters, model structure determination and parameter estimation using ordinary least squares an mixed estimation methods, At the same time problems of data collinearity detection and its assessment are discussed. These parts of methodology are demonstrated in examples using flight data of the X-29A and X-31A aircraft. In the third example wind tunnel oscillatory data of the F-16XL model are used. A strong dependence of these data on frequency led to the development of models with unsteady aerodynamic terms in the form of indicial functions. The paper is completed by concluding remarks.
Author
Aerodynamic Characteristics; X-29 Aircraft; X-31 Aircraft; Unsteady Aerodynamics; Supersonic Aircraft; Fighter Aircraft

19980210560 Army Research Lab., Vehicle Technology Center, Hampton, VA USA
Development of a Rotor-Body Coupled Analysis for an Active Mount Aeroelastic Rotor Testbed
Wilbur, Matthew L., Army Research Lab., USA; Jun. 1998; 108p; In English
Contract(s)/Grant(s): RTOP 581-20-21-01; DA Proj. A-5008
Report No.(s): NASA/TP-1998-208433; L-17596; NAS 1.60:208433; ARL-TR-1313; No Copyright; Avail: CASI; A06, Hardcopy; A02, Microfiche

At the Langley Research Center an active mount rotorcraft testbed is being developed for use in the Langley Transonic Dynamics Tunnel. This testbed, the second generation version of the Aeroelastic Rotor Experimental System (ARES-II), can impose rotor hub motions and measure the response so that rotor-body coupling phenomena may be investigated. An analytical method for coupling an aeroelastically scaled model rotor system to the ARES-II is developed in the current study. Models of the testbed and the rotor system are developed in independent analyses, and an impedance-matching approach is used to couple the rotor system to the testbed. The development of the analytical models and the coupling method is examined, and individual and coupled results are presented for the testbed and rotor system. Coupled results are presented with and without applied hub motion, and system loads and displacements are examined. The results show that a closed-loop control system is necessary to achieve desired hub motions, that proper modeling requires including the loads at the rotor hub and rotor control system, and that the strain-gauge balance placed in the rotating system of the ARES-II provided the best loads results.
Author
Rotary Wing Aircraft; Rotor Body Interactions; Rotors; Feedback Control; Airframes; Aeroelasticity; Impedance Matching

06
AIRCRAFT INSTRUMENTATION

Includes cockpit and cabin display devices; and flight instruments.

19980209658 NASA Lewis Research Center, Cleveland, OH USA
Using Neural Networks for Sensor Validation
Mattern, Duane L., Scientific Monitoring, Inc., USA; Jaw, Link C., Scientific Monitoring, Inc., USA; Guo, Ten–Huei, NASA Lewis Research Center, USA; Graham, Ronald, Allison Engine Co., USA; McCoy, William, Allison Engine Co., USA; Jul. 1998; 14p; In English; 34th; Joint Propulsion Conference, 12-15 Jul. 1998, Cleveland, OH, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA
Contract(s)/Grant(s): RTOP 519-30-53
Report No.(s): NASA/TM-1998-208483; E-11258; NAS 1.15:208483; AIAA Paper 98-3547; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This paper presents the results of applying two different types of neural networks in two different approaches to the sensor validation problem. The first approach uses a functional approximation neural network as part of a nonlinear observer in a model-based approach to analytical redundancy. The second approach uses an auto-associative neural network to perform nonlinear principal component analysis on a set of redundant sensors to provide an estimate for a single failed sensor. The approaches are demonstrated using a nonlinear simulation of a turbofan engine. The fault detection and sensor estimation results are presented and the training of the auto-associative neural network to provide sensor estimates is discussed.
Author
Neural Nets; Sensors; Fault Detection; Redundancy; Real Time Operation; Models; Engine Monitoring Instruments; In-Flight Monitoring; Fail-Safe Systems

19980210485 Smiths Industries Aerospace and Defense Systems, Inc., Grand Rapids, MI USA
Navy F/A-18 Crash Survivable Flight Incident Recorder (CSFIR): Minutes of Technical Interchange Meeting (TIM) 17-18 March 1998
Apr. 06, 1998; 5p; In English
Contract(s)/Grant(s): N00019-98-F-0003
Report No.(s): AD-A346391; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

On 17-18 Mar 98, representatives from Boeing and Smiths Industries (SI) met in St. Louis for a Technical Interchange Meeting (TIM) in support of the Crash Survivable Flight Incident Recorder (CSFIR) integration into F/A-18C/D aircraft. A list of the TIM participants is in attachment #1. The objective of this meeting was to coordinate changes to the draft CSFIR Interface Control Document (ICD), ICD-F/A-18-075, Revision Preliminary #2. The ICD defines the CSFIR when installed on the F/A-18 C/D aircraft. The objective of the TIM was met. SI gained a better understanding of the DFIR emulation requirement. These understand-

ings are listed below. However, in order for SI to scope the software development tasks necessary to integrate the VADR(trade name) on the F/A-18 aircraft further information is needed. A "Preliminary #3" revision to the Interface Control Document was generated (authored by Boeing) based on inputs from the participants of this TIM and will be reviewed prior to the next TIM. The resulting action items from this TIM are indicated in the report.
DTIC
Flight Recorders; F-18 Aircraft; Systems Integration

07
AIRCRAFT PROPULSION AND POWER

Includes prime propulsion systems and systems components, e.g., gas turbine engines and compressors; and onboard auxiliary power plants for aircraft.

19980206753 Arnold Engineering Development Center, Arnold AFS, TN USA
Transitioning Navy Aero Engine Test Capability
Boytos, Joseph F., Naval Air Warfare Center, USA; Lominac, John K., Arnold Engineering Development Center, USA; Jan. 1997; 12p; In English; 35th; Aerospace Sciences, 6-9 Jan. 1997, USA
Report No.(s): AD-A345893; AIAA Paper 97-0668; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The reduction in military force levels requires a corresponding decrease in the shore based infra-structure. Many bases and laboratories were selected for closure or realignment as part of the BRAC process. The Navy's aeropropulsion test facility at Trenton, NJ, would transfer its large and medium propulsion engine test capability to the Air Force's propulsion facility at Arnold Engineering Development Center, Arnold Air Force Base, TN. Two small altitude test cells will be disconnected and physically moved; the test capability of two large engine environmental test cells will be transferred by utilizing standard Air Force A/F32T-9 test cells as building blocks. The two T-9 cells will be modified to duplicate the ram air test capability of current Navy cells. The transition process is described from both technical and management viewpoints. Test facility requirements, funding, organizational responsibilities, partnering, and design and construction are discussed. Test cell scale model tests with engine simulators formed the basis for equipment modifications. Activation/validation efforts with appropriate engines will document the required test capability. Current program status and final test cell capabilities are presented. Criteria for engine performance measurement, engine/cell operability, and acoustical requirements are discussed. Operational capability for the altitude chambers is late 1997, and the large environmental sea level cells in late 1998.
DTIC
Ramjet Engines; Turbines; Transferring; Aircraft Engines

19980209647 NASA Lewis Research Center, Cleveland, OH USA
General Aviation Light Aircraft Propulsion: From the 1940's to the Next Century
Burkardt, Leo A., NASA Lewis Research Center, USA; Jul. 1998; 16p; In English; 34th; Joint Propulsion Conference, 12-15 Jul. 1998, Cleveland, OH, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA
Contract(s)/Grant(s): RTOP 523-12-13
Report No.(s): NASA/TM-1998-208411; NAS 1.15:208411; E-11246; AIAA Paper 98-3116; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Current general aviation light aircraft are powered by engines that were originally designed in the 1940's. This paper gives a brief history of light aircraft engine development, explaining why the air-cooled, horizontally opposed piston engine became the dominant engine for this class of aircraft. Current engines are fairly efficient, and their designs have been updated through the years, but their basic design and operational characteristics are archaic in comparison to modem engine designs, such as those used in the automotive industry. There have been some innovative engine developments, but in general they have not been commercially successful. This paper gives some insight into the reasons for this lack of success. There is now renewed interest in developing modem propulsion systems for light aircraft, in the fore-front of which is NASA's General Aviation Propulsion (GAP) program. This paper gives an overview of the engines being developed in the GAP program, what they will mean to the general aviation community, and why NASA and its industry partners believe that these new engine developments will bring about a new era in general aviation light aircraft.
Author
Propulsion System Configurations; Propulsion System Performance; Design Analysis; Aircraft Engines; Engine Design

19980210006 Garrett Turbine Engine Co., Phoenix, AZ USA
Small Engine Technology (Set) Task 8 Aeroelastic Prediction Methods *Final Report*
Eick, Chris D., Garrett Turbine Engine Co., USA; Liu, Jong–Shang, Garrett Turbine Engine Co., USA; Jun. 1998; 60p; In English; Original contains color illustrations
Contract(s)/Grant(s): NAS3-27483; RTOP 538-06-13
Report No.(s): NASA/CR-1998-202328; NAS 1.26:202328; E-10674; Rept-21-9157; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

AlliedSignal Engines, in cooperation with NASA LeRC, completed an evaluation of recently developed aeroelastic computer codes using test cases from the AlliedSignal Engines fan blisk database. Test data for this task includes strain gage, light probe, performance, and steady-state pressure information obtained for conditions where synchronous or flutter vibratory conditions were found to occur. Aeroelastic codes evaluated include the quasi 3-D UNSFLO (developed at MIT and modified to include blade motion by AlliedSignal), the 2-D FREPS (developed by NASA LeRC), and the 3-D TURBO-AE (under development at NASA LeRC). Six test cases each where flutter and synchronous vibrations were found to occur were used for evaluation of UNSFLO and FREPS. In addition, one of the flutter cases was evaluated using TURBO-AE. The UNSFLO flutter evaluations were completed for 75 percent radial span and provided good agreement with the experimental test data. Synchronous evaluations were completed for UNSFLO but further enhancement needs to be added to the code before the unsteady pressures can be used to predict forced response vibratory stresses. The FREPS evaluations were hindered as the steady flow solver (SFLOW) was unable to converge to a solution for the transonic flow conditions in the fan blisk. This situation resulted in all FREPS test cases being attempted but no results were obtained during the present program. Currently, AlliedSignal is evaluating integrating FREPS with our existing steady flow solvers to bypass the SFLOW difficulties. ne TURBO-AE steady flow solution provided an excellent match with the AlliedSignal Engines calibrated DAWES 3-D viscous solver. Finally, the TURBO-AE unsteady analyses also matched experimental observations by predicting flutter for the single test case evaluated.
Author
Aeroelasticity; Computational Fluid Dynamics; Fan Blades; Performance Prediction; Evaluation; Computer Programs

08
AIRCRAFT STABILITY AND CONTROL

Includes aircraft handling qualities; piloting; flight controls; and autopilots.

19980210483 NASA Dryden Flight Research Center, Edwards, CA USA
Development and Flight Test of an Emergency Flight Control System Using Only Engine Thrust on an MD-11 Transport Airplane
Burcham, Frank W., Jr., NASA Dryden Flight Research Center, USA; Burken, John J., NASA Dryden Flight Research Center, USA; Maine, Trindel A., NASA Dryden Flight Research Center, USA; Fullerton, C. Gordon, NASA Dryden Flight Research Center, USA; Oct. 1997; 98p; In English
Contract(s)/Grant(s): RTOP 522-15-34
Report No.(s): NASA/TP-1997-206217; H-2170; NAS 1.60:206217; No Copyright; Avail: CASI; A05, Hardcopy; A02, Microfiche

An emergency flight control system that uses only engine thrust, called the propulsion-controlled aircraft (PCA) system, was developed and flight tested on an MD-11 airplane. The PCA system is a thrust-only control system, which augments pilot flightpath and track commands with aircraft feedback parameters to control engine thrust. The PCA system was implemented on the MD-11 airplane using only software modifications to existing computers. Results of a 25-hr flight test show that the PCA system can be used to fly to an airport and safely land a transport airplane with an inoperative flight control system. In up-and-away operation, the PCA system served as an acceptable autopilot capable of extended flight over a range of speeds, altitudes, and configurations. PCA approaches, go-arounds, and three landings without the use of any normal flight controls were demonstrated, including ILS-coupled hands-off landings. PCA operation was used to recover from an upset condition. The PCA system was also tested at altitude with all three hydraulic systems turned off. This paper reviews the principles of throttles-only flight control, a history of accidents or incidents in which some or all flight controls were lost, the MD-11 airplane and its systems, PCA system development, operation, flight testing, and pilot comments.
Author
MD 11 Aircraft; Feedback Control; Flight Control; Thrust Control; Transport Aircraft; Emergencies

09
RESEARCH AND SUPPORT FACILITIES (AIR)

Includes airports, hangars and runways; aircraft repair and overhaul facilities; wind tunnels; shock tubes; and aircraft engine test stands.

19980206621 Los Alamos National Lab., NM USA

Megabar liner experiments on Pegasus 2

Lee, H., Los Alamos National Lab., USA; Bartsch, R. R., Los Alamos National Lab., USA; Bowers, R. L., Los Alamos National Lab., USA; 1997; 7p; In English; 11th; Pulsed Power Conference, 29 Jun. - 2 Jul. 1997, Baltimore, MD, USA; Sponsored by Institute of Electrical and Electronics Engineers, USA

Contract(s)/Grant(s): W-7405-ENG-36

Report No.(s): LA-UR-97-2412; CONF-9706113; DE97-008971; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

Using pulsed power to implode a liner onto a target can produce high shock pressures for many interesting application experiments. With a Pegasus-2 facility in Los Alamos, a detailed theoretical analysis has indicated that the highest attainable pressure is around 2 Mbar for a best designed aluminum liner. Recently, an interesting composite liner design has been proposed which can boost the shock pressure performance by a factor 4 over the aluminum liner. This liner design was adopted in the first megabar (Megabar-1) liner experiment carried out on Pegasus last year to verify the design concept and to compare the effect of Rayleigh-Taylor instabilities on liner integrity with the code simulations. We present briefly the physical considerations to explain why the composite liner provides the best shock pressure performance. The theoretical modeling and performance of Megabar-1 liner are discussed. Also presented are the first experimental results and the liner design modification for our next experiment.

DOE

Linings; Aluminum; Pressure Gradients; Pulse Generators; Implosions; Shock Waves

19980209947 ESDU International Ltd., London, UK

Example of Statistical Techniques Applied to Analysis of Paved Runway Sizes (Bivariate Normal Distribution)

Sep. 1996; 16p; In English; Included in the Aircraft Performance Sub-series

Report No.(s): ESDU-96024; No Copyright; Avail: Issuing Activity (ESDU International, 27 Corsham St., London, N1 6UA, UK), Hardcopy, Microfiche

Engineering Sciences Data Unit (ESDU) 96024 presents as an illustration of the use of the Bivariate Normal Distribution an analysis of data for the length and width of a sample of paved runways from two regions of the United States. The distribution of runways in terms of lengths and widths is of relevance to the operators of aircraft, for example in assessing the validity of airworthiness assumptions with respect to the probability of finding any particular width of runway. This can be relevant to the definition of minimum control speeds on the ground or the acceptable cross-wind limit. Transforms of the distributions of the length and width are found that are Normally distributed and simply correlated. The sample is then treated as a Bivariate Normal Distribution. The results are used, as an example, to assess the probabilities of runways being less than a particular length or width, or the probability that a runway of a particular width will be less than a particular length, or that a runway will be less than a particular width and length.

Author

Procedures; Runways; Statistical Analysis; Pavements; Data Structures

19980210390 Institute for Human Factors TNO, Soesterberg, Netherlands

Functional Simulator Requirements for the Chinook and the Cougar Transport Helicopters ***Final Report Functionele simulatoreisen voor de Chinook en de Cougar transporthelikopters***

vanRooij, J. C. G. M., Institute for Human Factors TNO, Netherlands; deVries, S. C., Institute for Human Factors TNO, Netherlands; Buitelaar, M., National Aerospace Lab., Netherlands; Ligthart, V., National Aerospace Lab., Netherlands; Brouwer, W., National Aerospace Lab., Netherlands; Roessingh, J. J. M., National Aerospace Lab., Netherlands; Verwey, W. B., Institute for Human Factors TNO, Netherlands; vanEmmerik, M. L., Institute for Human Factors TNO, Netherlands; Oct. 02, 1997; 96p; In English

Contract(s)/Grant(s): A95/KLu/357

Report No.(s): TNO-TM-97-A062; TD97-0245; Copyright; Avail: Issuing Activity (TNO Human Factors Research Inst., Kampweg 5, 3769 DE Soesterberg, The Netherlands); US Sales Only, Hardcopy, Microfiche

By the end of 1995 the Chinook CH-47D transport helicopter was introduced into the Royal Netherlands Air Force (RNLAF), In 1996 the AS 532 U2 Cougar MK2 transport helicopter has also entered service. Both helicopters are new to the RNLAF. The

purpose of both helicopters is to provide the Dutch Airmobile Brigade with the required tactical mobility. It is the intention of the RNLAF to perform part of the helicopter-crew training in helicopter simulators. However, at the moment no specific plans exist delineating which part of the training should be done in a simulator. The RNLAF has commissioned the TNO Human Factors Research Institute and the National Aerospace Laboratory NLR to inventory and analyse the available information and to advise on the training and simulation requirements. In order to keep the choice of options as unrestricted as possible, a number of hierarchically layered training clusters has been specified, each leading to a specific simulator configuration. The training clusters range from simple and restricted to complex and comprehensive, where it is understood that each cluster includes all elements of its predecessors: (1) instrument-based procedural training; (2) procedure and simple maneuver training; (3) standard maneuver training and disturbances; (4) degraded mode maneuver training; (5) critical and sling maneuver training. Each of these clusters has been consecutively analysed with respect to its skill, cue, and simulation requirements according to a common systematic approach. In addition to the requirements that are associated with each of the training need clusters, requirements with respect to Night Vision Goggles (NVG) training and with respect to the Instructor Operator Station (IOS) have been specified. On the basis of the requirements that have been specified, cost assessments have been made. The report concludes with a number of recommendations with respect to the acquisition of the required training and simulation capability.
Author
Armed Forces; Training Simulators; CH-47 Helicopter; Functional Design Specifications; Goggles; Night Vision

19980210622 Institute for Human Factors TNO, Soesterberg, Netherlands
Low-Cost Simulators 1d: Generic Training Simulators for Military Applications ***Interim Report Low-Cost Simulatoren 1d: Generieke Traingssimulatoren voor Militaire Toepassingen***
Korteling, J. E., Institute for Human Factors TNO, Netherlands; Helsdingen, A. S., Institute for Human Factors TNO, Netherlands; Dec. 30, 1997; 35p; In English
Contract(s)/Grant(s): A96/CO/363; Proj. 788.1
Report No.(s): TD97-0487; TM-97-A087; Copyright; Avail: Issuing Activity (TNO Human Factors Research Inst., Kapmweg 5, 3769 De Soesterberg, The Netherlands); US Sales Only, Hardcopy, Microfiche

To investigate the possibilities for application of low-cost simulators within military training courses, the research project called ELSTAR (European Low-cost Simulation Technology for the ARmed forces) is carried out under contract of the Ministries of Defence of the five participating countries of Research Technology Project (RTP) 11.8, viz. Belgium, France, Germany, Greece, and The Netherlands. In the first part of this investigation, i.e. workpackage la, a taxonomy constituting 100 military task domains (ELSTAR Taxonomy) was a.o. developed and these 1 00 domains were evaluated on 1 5 criteria relevant for low-cost simulator applications and R&D. This resulted in a concise set of 9 military training areas that represented 29 task domains that were selected for further study. These 9 training areas were then further investigated in workpackage lb and 1 c. This involved task- and cost-utility analyses on specific training courses that were considered representative for the 9 selected training areas. The present report describes the selection of 4 training areas out of these 9 training areas, and provides the global functional specifications of generic training simulators that could be applied in training programmes within these areas. This selection is based on scores on the ELSTAR taxonomy, the results of the task-, training-, and cost-utility analysis, and expert judgements on the generic value and complementarity of the knowledge that will be acquired. The results show that driver training, UAV crew training, infrared and image intensifier operation training, and mission management training will be most suitable for further research into the possibilities for the application of low-cost simulators. Functional specifications that are drawn up for training systems for these training areas, indicate the global simulator requirements and which task clusters may be simulated at low-cost. In subsequent workpackages, more detailed requirements for the selected training systems will be specified.
Author
Low Cost; Training Simulators; Cost Analysis; Education; Military Technology; Systems Simulation

19980210752 Fermi National Accelerator Lab., Batavia, IL USA
1400 Liter 1.8 K Test Facility
Peterson, T. J., Fermi National Accelerator Lab., USA; Rabehl, R. J., Fermi National Accelerator Lab., USA; Sylvester, C. D., Fermi National Accelerator Lab., USA; Aug. 1997; 10p; In English; Joint Cryogenic Engineering Conference and International Cryogenic Materials Conference, 27 Jul. - 1 Aug. 1997, Portland, OR, USA
Contract(s)/Grant(s): DE-AC02-76CH-03000
Report No.(s): FNAL/C-97/268; CONF-970758; DE97-054295; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

A double bath superfluid helium dewar has been constructed and operated at Fermilab's Magnet Test Facility. The 1.8 K portion of the dewar is sized to contain a superconducting magnet up to 0.5 meters in diameter and 4 meters long in a vertical orienta-

tion in 0.12 MPa pressurized superfluid. The dewar can also provide a subcooled Helium I environment for tests; the entire temperature range from 4.4 K to 1. 8 K at 0.12 MPa is available. This paper describes the system design, lambda plate, heat exchanger, and performance.
DOE
Test Facilities; Environmental Tests; Heat Exchangers; Cryogenic Equipment; Design; Liquid Helium 2

11
CHEMISTRY AND MATERIALS

Includes chemistry and materials (general); composite materials; inorganic and physical chemistry; metallic materials; nonmetallic materials; propellants and fuels; and materials processing.

19980210288 NASA Lewis Research Center, Cleveland, OH USA
Preliminary Tuft Testing of Metallic Bristles Versus PS212, PS300, and HVOF300
Fellenstein, James A., Ohio Aerospace Inst., USA; DellaCorte, Christopher, NASA Lewis Research Center, USA; Jun. 1998; 8p; In English, 17-21 May 1998, Detroit, MI, USA; Sponsored by Society of Tribologists and Lubrication Engineers, USA
Contract(s)/Grant(s): NCC3-440; RTOP 523-22-13
Report No.(s): NASA-TM-107522; NAS 1.15:107522; E-10835; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

Turbine engine brush seals are designed with sacrificial brushes and hard shaft coatings to minimize shaft wear and reduce the cost of engine overhauls. Replacing a worm seal is more cost and time effective than refinishing an engine shaft. However, this tribological design causes excessive brush wear and reduces long term seal efficiency. An alternative approach is to coat the shaft with a solid lubricant and allow the bristles to wear into the shaft coating similar to traditional abradable labyrinth seals. This approach can result in reduced seal leakage by forcing the leakage to flow through the seal bristle pack or through a more tortuous shaft wear track. Key to this approach is limiting the shaft wear to an acceptable level were surface refinishing would not be required during every engine overhaul. Included in this paper are brush seal tuft test results for four metallic bristles (nickel-chrome or cobalt-chrome based superalloys) tested against three solid lubricant coatings (NASA's PS212, PS300, and HVOF300). These test results are also compared to previous baseline tests conducted with plasma sprayed chrome carbide. Compared to the baseline results, no tribological benefit was achieved with the metallic bristle/solid lubricant tribopairs tested. to improve the performance of the solid lubricant coatings, issues regarding lubricant phase sizes (homogeneity), and composition need to be addressed.
Author
Turbine Engines; Brush Seals; Coating; Heat Resistant Alloys; Abrasion

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ENGINEERING

Includes engineering (general); communications and radar; electronics and electrical engineering; fluid mechanics and heat transfer; instrumentation and photography; lasers and masers; mechanical engineering; quality assurance and reliability; and structural mechanics.

19980206754 Sverdrup Technology, Inc., Arnold AFS, TN USA
A Three-Dimensional Turbine Engine Analysis Compressor Code (TEACC) for Steady-State Inlet Distortion
Hale, Alan, Sverdrup Technology, Inc., USA; OBrien, Walter, Sverdrup Technology, Inc., USA; Jan. 1997; 12p; In English
Report No.(s): AD-A345894; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The direct approach of modeling the flow between all blade passages for each blade row in the compressor is too computationally intensive for practical design and analysis investigations with inlet distortion. Therefore a new simulation tool called the Turbine Engine Analysis Compressor Code (TEACC) has been developed. TEACC solves the compressible, time dependent, 3D Euler equations modified to include turbomachinery source terms which represent the effect of the blades. The source terms are calculated for each blade row by the application of a streamline curvature code. TEACC was validated against experimental data from the transonic NASA rotor, Rotor 1B, for a clean inlet and for an inlet distortion produced by a 90 deg, one per revolution distortion screen. TEACC revealed that strong swirl produced by the rotor caused the compressor to increase in loading in the direction of rotor rotation through the distorted region and decrease in loading circumferentially away from the distorted region.
DTIC
Gas Turbines; Three Dimensional Models; Turbine Engines; Computer Programs; Flow Distribution; Turbocompressors

19980210185 Allison Engine Co., Indianapolis, IN USA
Hybrid Vehicle Turbine Engine Technology Support (HVTE-TS) ceramic design manual
Oct. 1997; 29p; In English
Contract(s)/Grant(s): DE-AC02-96EE-50453
Report No.(s): DOE-0336-7; EDR-18119; DE98-001952; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

This ceramic component design manual was an element of the Advanced Turbine Technology Applications Project (ATTAP). The ATTAP was intended to advance the technological readiness of the ceramic automotive gas turbine engine as a primary power plant. of the several technologies requiring development before such an engine could become a commercial reality, structural ceramic components represented the greatest technical challenge, and was the prime focus of the program. HVTE-TS, which was created to support the Hybrid Electric Vehicle (HEV) program, continued the efforts begun in ATTAP to develop ceramic components for an automotive gas turbine engine. In HVTE-TS, the program focus was extended to make this technology applicable to the automotive gas turbine engines that form the basis of hybrid automotive propulsion systems consisting of combined batteries, electric drives, and on-board power generators as well as a primary power source. The purpose of the ceramic design manual is to document the process by which ceramic components are designed, analyzed, fabricated, assembled, and tested in a gas turbine engine. Interaction with ceramic component vendors is also emphasized. The main elements of the ceramic design manual are: an overview of design methodology; design process for the AGT-5 ceramic gasifier turbine rotor; and references. Some reference also is made to the design of turbine static structure components to show methods of attaching static hot section ceramic components to supporting metallic structures.
DOE
Hybrid Propulsion; Turbines; Technology Utilization; Ceramics; Manuals; Fabrication; Automated Guideway Transit Vehicles; Electric Motor Vehicles; Gas Turbine Engines; Structural Design

19980210237 Hampton Univ., VA USA
Mixing, Noise and Thrust Benefits Using Corrugated Designs, *1 Jun. 1997 - 31 May 1998*
White, Samuel G., Hampton Univ., USA; Gilinsky, Mikhail M., Hampton Univ., USA; 1998; 4p; In English
Contract(s)/Grant(s): NAG1-1936; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

This project was conducted as a support for effective research, training and teaching of Hampton University students in Fluid Mechanics and Acoustics. Basically, this work is organized and implemented by the new Fluid Mechanics and Acoustics Laboratory (FM & AL) which was established at Hampton University in the School of Engineering and Technology (E & T) in 1996. In addition, FM & AL in cooperation with NASA LaRC jointly conducts research with the Central AeroHydrodynamics Institute (TSAGI, Moscow) in Russia under a 2 year Civilian Research and Development Foundation (CRDF). This project is also conducted under control of NASA HQ. For fulfillment of the current project, several researchers were involved as was shown in the proposal to NASA in 1996. This work is the development and support for projects solve problems with the goal of reducing jet noise and increasing nozzle thrust.
Derived from text
Noise Reduction; Jet Aircraft Noise; Acoustics; Fluid Mechanics

19980210623 Thiokol Chemical Corp., Brigham City, UT USA
Residual Stress Measurements After Proof and Flight: ETP-0403 *Final Report*
Webster, Ronald L.., Thiokol Chemical Corp., USA; Nov. 18, 1997; 102p; In English
Contract(s)/Grant(s): NAS8-38100
Report No.(s): NASA/CR-1997-208242; NAS 1.26:208242; TWR-18901; No Copyright; Avail: CASI; A06, Hardcopy; A02, Microfiche

The intent of this testing was to evaluate the residual stresses that occur in and around the attachment details of a case stiffener segment that has been subjected to flight/recovery followed by proof loading. Not measured in this test were stresses relieved at joint disassembly due to out-of-round and interference effects, and those released by cutting the specimens out of the case segment. The test article was lightweight case stiffener segment 1U50715, S/N L023 which was flown in the forward stiffener position on flight SRM 14A and in the aft position on flight SRM24A. Both of these flights were flown with the 3 stiffener ring configuration. Stiffener L023 had a stiffener ring installed only on the aft stub in its first flight, and it had both rings installed on its second flight. No significant post flight damage was found on either flight. Finally, the segment was used on the DM-8 static test motor in the forward position. No stiffener rings were installed. It had only one proof pressurization prior to assignment to its first use, and it was cleaned and proof tested after each flight. Thus, the segment had seen 3 proof tests, two flight pressurizations, and two low intensity water impacts prior to manufacturing for use on DM-8. On DM-8 it received one static firing pressurization in the hori-

zontal configuration. Residual stresses at the surface and in depth were evaluated by both the x-ray diffraction and neutron beam diffraction methods. The x-ray diffraction evaluations were conducted by Technology for Energy Corporation (TEC) at their facilities in Knoxville, TN. The neutron beam evaluations were done by Atomic Energy of Canada Limited (AECL) at the Chalk River Nuclear Laboratories in Ontario. The results showed general agreement with relatively high compressive residual stresses on the surface and moderate to low subsurface tensile residual stresses.
Author
Tensile Stress; Solid Rocket Binders; Stress Measurement; Static Tests; Static Firing; Horizontal Flight; Space Shuttle Boosters; Flight Characteristics

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GEOSCIENCES

Includes geosciences (general); earth resources and remote sensing; energy production and conversion; environment pollution; geophysics; meteorology and climatology; and oceanography.

19980210137 National Renewable Energy Lab., Golden, CO USA
Wind turbine design codes: A preliminary comparison of the aerodynamics
Buhl, M. L., Jr., National Renewable Energy Lab., USA; Wright, A. D., National Renewable Energy Lab., USA; Tangler, J. L., National Renewable Energy Lab., USA; Dec. 1997; 9p; In English; 17th; Wind Energy Symposium, 12-15 Jan. 1998, Reno, NV, USA; Sponsored by American Society of Mechanical Engineers, USA
Contract(s)/Grant(s): DE-AC36-83CH-10093
Report No.(s): NREL/CP-500-23975; CONF-980104; DE98-001789; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

The National Wind Technology Center of the National Renewable Energy Laboratory is comparing several computer codes used to design and analyze wind turbines. The first part of this comparison is to determine how well the programs predict the aerodynamic behavior of turbines with no structural degrees of freedom. Without general agreement on the aerodynamics, it is futile to try to compare the structural response due to the aerodynamic input. In this paper, the authors compare the aerodynamic loads for three programs: Garrad Hassan's BLADED, their own WT-PERF, and the University of Utah's YawDyn. This report documents a work in progress and compares only two-bladed, downwind turbines.
DOE
Wind Turbines; Computer Programs; Computer Aided Design; Aerodynamics; Computerized Simulation

19980210146 Sandia National Labs., Albuquerque, NM USA
Development of a light-weight, wind-turbine-rotor-based data acquisition system
Berg, D. E., Sandia National Labs., USA; Rumsey, M., Sandia National Labs., USA; Robertson, P., Sandia National Labs., USA; Kelley, N., National Renewable Energy Lab., USA; McKenna, E., National Renewable Energy Lab., USA; Gass, K., Utah State Univ., USA; [1997]; 12p; In English; Wind Energy, 12-15 Jan. 1998, Reno, NV, USA; Sponsored by American Society of Mechanical Engineers, USA
Contract(s)/Grant(s): DE-AC04-94AL-85000
Report No.(s): SAND-97-3003C; CONF-980104; DE98-001368; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

Wind-energy researchers at Sandia National Laboratories (SNL) and the National Renewable Energy Laboratory (NREL) are developing a new, light-weight, modular system capable of acquiring long-term, continuous time-series data from current-generation small or large, dynamic wind-turbine rotors. Meetings with wind-turbine research personnel at NREL and SNL resulted in a list of the major requirements that the system must meet. Initial attempts to locate a commercial system that could meet all of these requirements were not successful, but some commercially available data acquisition and radio/modem subsystems that met many of the requirements were identified. A time synchronization subsystem and a programmable logic device subsystem to integrate the functions of the data acquisition, the radio/modem, and the time synchronization subsystems and to communicate with the user have been developed at SNL. This paper presents the data system requirements, describes the four major subsystems comprising the system, summarizes the current status of the system, and presents the current plans for near-term development of hardware and software.
DOE
Computer Programming; Computer Programs; Data Acquisition; Rotors

19980210419 National Renewable Energy Lab., Golden, CO USA
Atmospheric tests of trailing-edge aerodynamic devices
Miller, L. S., Wichita State Univ., USA; Huang, S., Wichita State Univ., USA; Quandt, G. A., National Renewable Energy Lab., USA; Jan. 1998; 41p; In English
Contract(s)/Grant(s): DE-AC36-83CH-10093
Report No.(s): NREL/SR-500-22350; DE98-002764; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

An experiment was conducted at the National Renewable Energy Laboratory's (NREL's) National Wind Technology Center (NWTC) using an instrumented horizontal-axis wind turbine that incorporated variable-span, trailing-edge aerodynamic brakes. The goal of the investigation was to directly compare results with (infinite-span) wind tunnel data and to provide information on how to account for device span effects during turbine design or analysis. Comprehensive measurements were used to define effective changes in the aerodynamic and hinge-moment coefficients, as a function of angle of attack and control deflection, for three device spans (7.5%, 15%, and 22.5%) and configurations (Spoiler-Flap, vented sileron, and unvented aileron). Differences in the lift and drag behavior are most pronounced near stall and for device spans of less than 15%. Drag performance is affected only minimally (about a 30% reduction from infinite-span) for 15% or larger span devices. Interestingly, aerodynamic controls with vents or openings appear most affected by span reductions and three-dimensional flow.
DOE
Aerodynamic Coefficients; Moment Distribution; Three Dimensional Flow; Wind Turbines; Aerodynamic Brakes; Control Equipment; Design Analysis

19980210655 Forschungsinstitut fuer Hochfrequenzphysik, Werthhoven, Germany
Airborne Dual Sensor Millimeter Wave-Signatures of Maritime Targets and Sea-Clutter
Makaruschka, R., Forschungsinstitut fuer Hochfrequenzphysik, Germany; Essen, H., Forschungsinstitut fuer Hochfrequenzphysik, Germany; Apr. 1998; 7p; In English; Also announced as 19980210650; Copyright Waived; Avail: CASI; A02, Hardcopy; A04, Microfiche

In the framework of a NATO measurement campaign airborne signature measurements were conducted over sea with the dual frequency, polarimetric mm W Synthetic Aperture Radar MEMPHIS (Millimeterwave Experimental Multifrequency Polarimetric High Resolution Imaging System) with simultaneous operating front-ends at 35 GHz and 94 GHz onboard a cargo aircraft in side-looking configuration. Both front-ends are tied to the same system reference and are using the same IF pre-processing and radar waveform-generator. So as well a concise comparison between data at relevant mm W bands simultaneously. the two frequency bands, 35 GHz and 94 GHz, can be made The performance data of the front-ends are summarized in as a use of the data for multichannel/multifrequency SAR processing. The paper describes the system configuration and the mm W-SAR processing algorithm and gives representative results for the generated radar images for ship targets, chaff and the sea clutter with emphasis on the multiparameter evaluation.
Author
Airborne Equipment; Aircraft Configurations; Radar Imagery; Synthetic Aperture Radar; Millimeter Waves; Imaging Techniques

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LIFE SCIENCES

Includes life sciences (general); aerospace medicine; behavioral sciences; man/system technology and life support; and space biology.

19980209727 Defence and Civil Inst. of Environmental Medicine, Downsview, Ontario Canada
Water Entry Onto the MAC 200 Immersion Suit During Simulated Parachute Jump and Drag Trials
Ducharme, Michel B., Defence and Civil Inst. of Environmental Medicine, Canada; Thompson, John A., Defence and Civil Inst. of Environmental Medicine, Canada; Jan. 1998; 15p; In English
Report No.(s): AD-A345838; DCIEM-98-R-33; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The MAC 200 immersion suit newly developed by Mustang Survival (Richmond, B.C.) has recently been considered a potential replacement suit for the constant wear dry immersion suit currently used by Canadian Forces aircrew. The objective of the present evaluation trial was to evaluate the effectiveness of the new neck seal concept by measuring water leakage into the MAC 200 suit during a simulated parachute jump into water followed by a 15 s drag. Four male aircrew members volunteered to participate in the study. On Day 1 they jumped from the back of a boat (about 30 cm above the water) moving at a speed of 5 km . h-1 and were dragged for 15 sec. On Day 2, the aircrew jumped from a platform 3 m above water to simulate the speed of parachute entry and were immediately attached to a line and dragged behind a boat for 15 sec at a speed of 5 km/h. Before and after the

jump/drag procedure the aircrew were weighed to estimate the amount of water leakage into the suit. The results showed that when the neck and wrist seals of the suit were closed properly before the entry into the water, no leakage was observed following the jump/drag procedure on both testing days.
DTIC
Parachutes; Protective Clothing; Water Immersion; Wettability

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MATHEMATICAL AND COMPUTER SCIENCES

Includes mathematical and computer sciences (general); computer operations and hardware; computer programming and software; computer systems; cybernetics; numerical analysis; statistics and probability; systems analysis; and theoretical mathematics.

19980206782 Sandia National Labs., Albuquerque, NM USA
Introduction to NuMAD: A numerical manufacturing and design tool
Laird, D. L., Sandia National Labs., USA; Ashwill, T. D., Sandia National Labs., USA; 1997; 8p; In English; 16th; Wind Energy, 6 - 9 Jan. 1997, Reno, NV, USA; Sponsored by American Society of Mechanical Engineers, USA
Contract(s)/Grant(s): DE-AC04-94AL-85000
Report No.(s): SAND-97-2746C; AIAA Paper 98-0060; CONF-970135-; DE98-001042; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

Given the complex geometry of most wind turbine blades, structural modeling using the finite element method is generally performed using a unique model for each particular blade analysis. Development time (often considerable) spent creating a model for one blade may not aid in the development of a model for a different blade. In an effort to reduce model development time and increase the usability of advanced finite element analysis capabilities, a new software tool, NuMAD, is being developed.
DOE
Turbine Blades; Models; Finite Element Method; Computer Aided Design; Computer Aided Manufacturing; Applications Programs (Computers); Airfoils

19980210017 NASA Ames Research Center, Moffett Field, CA USA
Comparison of Five System Identification Algorithms for Rotorcraft Higher Harmonic Control
Jacklin, Stephen A., NASA Ames Research Center, USA; May 1998; 152p; In English
Report No.(s): NASA/TP-1998-207687; A-977183; NAS 1.60:207687; No Copyright; Avail: CASI; A08, Hardcopy; A02, Microfiche

This report presents an analysis and performance comparison of five system identification algorithms. The methods are presented in the context of identifying a frequency-domain transfer matrix for the higher harmonic control (HHC) of helicopter vibration. The five system identification algorithms include three previously proposed methods: (1) the weighted-least- squares-error approach (in moving-block format), (2) the Kalman filter method, and (3) the least-mean-squares (LMS) filter method. In addition there are two new ones: (4) a generalized Kalman filter method and (5) a generalized LMS filter method. The generalized Kalman filter method and the generalized LMS filter method were derived as extensions of the classic methods to permit identification by using more than one measurement per identification cycle. Simulation results are presented for conditions ranging from the ideal case of a stationary transfer matrix and no measurement noise to the more complex cases involving both measurement noise and transfer-matrix variation. Both open-loop identification and closed- loop identification were simulated. Closed-loop mode identification was more challenging than open-loop identification because of the decreasing signal-to-noise ratio as the vibration became reduced. The closed-loop simulation considered both local-model identification, with measured vibration feedback and global-model identification with feedback of the identified uncontrolled vibration. The algorithms were evaluated in terms of their accuracy, stability, convergence properties, computation speeds, and relative ease of implementation.
Author
Algorithms; Feedback Control; Harmonic Control; Helicopters; Kalman Filters; Matrices (Mathematics); Rotary Wing Aircraft

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PHYSICS

Includes physics (general); acoustics; atomic and molecular physics; nuclear and high-energy; optics; plasma physics; solid-state physics; and thermodynamics and statistical physics. (General)

19980206466 NASA Lewis Research Center, Cleveland, OH USA
Space Acceleration Measurement System (SAMS)/Orbital Acceleration Research Experiment (OARE)
Hakimzadeh, Roshanak, NASA Lewis Research Center, USA; Life and Microgravity Spacelab (LMS); Feb. 1998, pp. 319-335; In English; Also announced as 19980206462; No Copyright; Avail: CASI; A03, Hardcopy; A06, Microfiche

The Life and Microgravity Spacelab (LMS) payload flew on the Orbiter Columbia on mission STS-78 from June 20th to July 7th, 1996. The LMS payload on STS-78 was dedicated to life sciences and microgravity experiments. Two accelerometer systems managed by the NASA Lewis Research Center (LERC) flew to support these experiments, namely the Orbital Acceleration Research Experiment (OARE) and the Space Acceleration Measurements System (SAMS). In addition, the Microgravity Measurement Assembly (NOAA), managed by the European Space Research and Technology Center (ESA/ESTEC), and sponsored by NASA, collected acceleration data in support of the experiments on-board the LMS mission. OARE downlinked real-time quasi-steady acceleration data, which was provided to the investigators. The SAMS recorded higher frequency data on-board for post-mission analysis. The MMA downlinked real-time quasi-steady as well as higher frequency acceleration data, which was provided to the investigators. The Principal Investigator Microgravity Services (PIMS) project at NASA LERC supports principal investigators of microgravity experiments as they evaluate the effects of varying acceleration levels on their experiments. A summary report was prepared by PIMS to furnish interested experiment investigators with a guide to evaluate the acceleration environment during STS-78, and as a means of identifying areas which require further study. The summary report provides an overview of the STS-78 mission, describes the accelerometer systems flown on this mission, discusses some specific analyses of the accelerometer data in relation to the various activities which occurred during the mission, and presents plots resulting from these analyses as a snapshot of the environment during the mission. Numerous activities occurred during the STS-78 mission that are of interest to the low-gravity community. Specific activities of interest during this mission were crew exercise, radiator deployment, Vernier Reaction Control System (VRCS) reboost, venting operations, Flight Control System (FCS) checkout, rack excitation, operation of the Life Sciences Laboratory Equipment Refrigerator/Freezer (LSLE R/F), operation of the JSC Projects Centrifuge, crew sleep, and attitude changes. The low-gravity environment related to these activities is discussed in the summary report.
Author
Microgravity; Gravitational Effects; Acceleration Measurement; Flight Control; Accelerometers; Aerospace Environments; Spacecrews; Acceleration Tolerance; Spaceborne Experiments; Deployment

19980206652 Los Alamos National Lab., NM USA
Caballero: A high current flux compressor system for 100 MJ solid liner experiments
Reinovsky, R. E., Los Alamos National Lab., USA; Lindemuth, I. R., Los Alamos National Lab., USA; Lopez, E. A., Los Alamos National Lab., USA; Goforth, J. H., Los Alamos National Lab., USA; Marsh, S. P., Los Alamos National Lab., USA; 1997; 8p; In English; 11th; Pulsed Power Conference, 29 Jun. - 2 Jul. 1997, Baltimore, MD, USA; Sponsored by Institute of Electrical and Electronics Engineers, USA
Contract(s)/Grant(s): W-7405-ENG-36
Report No.(s): LA-UR-97-2722; CONF-9706113; DE98-000595; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Hardcopy, Microfiche

Pulse power systems delivering in excess of 100 MJ represent one of the next major challenges to the pulse power community. While a laboratory pulse power system in this energy range if feasible, it represents a very substantial investment of both time and resources. Prudence requires that fundamental proof-of-principle for the contemplated application is established before such massive resources are committed. Explosive pulse power systems using magnetic flux compression provide a direct path to such demonstrations. Furthermore, as energy requirements grow, single use explosive systems may represent the only affordable source of ultra-high energy environments.
DOE
Compressors; Magnetic Flux; High Current; Pulse Generators; Magnetic Compression

19980210789 Technical Univ. of Denmark, Afd. for Fluid Mekanik, Lyngby, Denmark
Aero-acoustic noise of wind turbines: Noise prediction models
Maribo Pedersen, B., Editor, Technical Univ. of Denmark, Denmark; 1997; 126p; In English; 29th; Experts on Aero-Acoustic Noise of Wind Turbines, 17-18 Mar. 1997, Milano, Italy

Report No.(s): NEI-DK-3024; CONF-9703137; DE98-718941; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

Semi-empirical and CAA (Computational AeroAcoustics) noise prediction techniques are the subject of this expert meeting. The meeting presents and discusses models and methods. The meeting may provide answers to the following questions: What Noise sources are the most important? How are the sources best modeled? What needs to be done to do better predictions? Does it boil down to correct prediction of the unsteady aerodynamics around the rotor? Or is the difficult part to convert the aerodynamics into acoustics?

DOE

Aeroacoustics; Aerodynamic Noise; Mathematical Models; Noise Prediction; Wind Turbines; Rotors

17
SOCIAL SCIENCES

Includes social sciences (general); administration and management; documentation and information science; economics and cost analysis; law, political science, and space policy; and urban technology and transportation.

19980210652 British Aerospace Public Ltd. Co., Military Aircraft and Aerostructures, Lancashire, UK

Aircraft Sensor Data Fusion: An Improved Process and the Impact of ESM Enhancements

Noonan, C. A., British Aerospace Public Ltd. Co., UK; Pywell, M., British Aerospace Public Ltd. Co., UK; Multi-Sensor Systems and Data Fusion for Telecommunications, Remote Sensing and Radar; Apr. 1998; 10p; In English; Also announced as 19980210650; Copyright Waived; Avail: CASI; A02, Hardcopy; A04, Microfiche

British Aerospace Military Aircraft and Aerostructures (BAe MA&A) has conducted various studies on the topic of Data Fusion. This paper highlights developments which, it is thought, offer a significant step towards optimum situation awareness. It examines sensor data quality, the fusion process and method function. The paper also examines the key issues affecting quality of track data fed into the fusion process by Electronic Support Measures systems (ESM), the prime threat identity data. Emitter recognition and location issues are discussed and potential routes are proposed to attain the necessary performance increases to support optimum situation However, lack of adherence to a known plan is not a conclusive awareness.

Author

Multisensor Fusion; Emitters; Remote Sensing; Aircraft Production

Subject Term Index

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